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STANDARDIZATION OF PORTABLE CORDS.

The early standardization of sockets and lamp bases in this country was a great boon to the industry. The advantage of a similar standardization of plugs and receptacles has been very generally recognized and steps have been taken toward the attainment of this end. The consummation of an agreement between the manufacturers which will result in the uniformity of these items of their product will appreciably advance the industry as a whole by making current-consuming devices more popular. The Committee on Wiring of the National Electric Light Association has given considerable attention to the matter and has made its recommendations. The final step rests with the manufacturers, and any one or more failing to co-operate in this matter is likely to feel his unpopularity in a diminished demand for his goods.

At the meeting of the Committee on Wiring, which was reported in the last issue, the question of uniformity in the contact devices at the other end of the connecting cord was also discussed. While uniformity at this point may not be quite as important as in the previous case, it is nevertheless an appropriate subject for standardization, and especially so at the same time as the plugs and receptacles. It involves the provision by manufacturers of devices having similar conducting terminals, or at least terminals which will fit a common form of terminal on the end of the connecting cord. Such a condition may at first seem difficult of realization, and it may involve the partial redesign of certain appliances, but the resultant advantages would far outweigh all the difficulties. It seems ridiculous that it should be necessary to have a separate connecting cord for every device which may be used in the household, and yet this is almost literally true, especially with devices of different manufacture. It is seldom that all such devices would be in use at one time, and in many homes not more than one would ever be used at one time, and it is both an unnecessary inconvenience and an unnecessary expense to have to change cords when turning from the use of one appliance to utilize another. This applies especially to appliances consuming not more than 600 watts. For heating or cooking apparatus of larger size there is less need of interchangeability and for some reasons such interchangeability might be undesirable.

Our contemporary, *The Electrical Times*, of London, has recently devoted a portion of two issues (Oc-

tober 14 and 21) to a discussion of this question. The terminals of various forms of heating and cooking apparatus are illustrated and their weaknesses considered. It is stated that to be satisfactory a connector should be made of some non-hygroscopic material which is strong mechanically, of high resistance, capable of withstanding high temperatures, and neither brittle nor soft. Certainly all of these qualities are desirable. Porcelain answers these requirements only when incased in metal, but the modern molded insulating materials made from condensation products should prove satisfactory. Wood, ebonite, fiber, marble and many other common insulating materials are unsuited to this purpose.

The conducting terminals of the cord should, of course, be countersunk, so that if disconnected while alive it would not be easy to either get a shock or cause a short-circuit. Convenience of handling should receive consideration, and many minor details need to receive attention if a thoroughly and permanently satisfactory terminal is to be evolved.

Since devices of this character have become objects of considerable international trade, it would be well if such standardization should be made international, rather than merely national. At least co-operation in Great Britain and this country might be secured, and that would indeed be something accomplished.

BONUS SYSTEMS FOR ELECTRICITY EMPLOYEES.

The bonus principle has been successfully applied in connection with a number of public electricity undertakings in England. Engineers and managers who have adopted it have considered the results to amply justify the application in many cases; of course, as in everything else, there have been exceptions. Within quite recent times bonus allowances have been made to street-car drivers for economical use of power, and to boiler-house stokers for economy in consumption of fuel; managers, canvassers and other members of commercial staffs have received percentage bonuses on either the new lamp and power connections made, or on the increase in the annual sale of electricity.

War-time has, however, given rise to special conditions, and many undertakings have made special war-bonus allowances to employees, based not upon either economies effected or additional business secured, but adopted entirely because wage additions have been pretty generally made in many departments of activity in order to meet the increased cost of living consequent upon war conditions. Such allowances as these, however, do not come in the same category as those granted under schemes which have for their object either the development of the electricity load or the more economical and therefore more efficient operation of a system.

The borough electrical engineer of Maidstone, England, has recommended his authority to introduce at once a co-partnership or bonus scheme which will embrace the whole of the staff, and which will not be operated with any idea or intention of "giving the staff anything." His investigation of practice along such lines in other towns in England is that the engineers of undertakings which have adopted it unanimously advocate it as a good investment, and among electricity managers generally the idea is rapidly growing in favor. Mr. Hoadley, the engineer referred to, says that in view of the altered relations between capital and labor which now exist, and which will exist to a greater degree for some time, he recommends such a co-partnership scheme for Maidstone as a means of promoting the unity of purpose between the committee responsible for the higher control and policy, and the staff who have to carry out that policy, in order to obtain the highest efficiency in the working of departments.

ADDRESSES TO COMMERCIAL BODIES.

Central-station managers and their chief assistants are in increasing demand in many localities as speakers at luncheons of business men's organizations, and the good which this sort of activity does the electrical industry cannot easily be exaggerated. The respect which the general public has for the electrical opinions of a responsible executive or department head in a modern central station is often but little realized inside the local company, but here is real material for development—a basis on which to build a pretty respectable sort of structure.

A good many times when the central-station man accepts an invitation to speak before the local Rotary Club at some noonday celebration, or perhaps finds himself on the program without any personal consultation, the task looks most burdensome. He wonders what he can say that will be of interest and at the same time help the electrical art along its shining way. Here a real danger presents itself. The speaker-to-be may take the easier course and decide to give a general talk about the convenience, safety and all-around attractiveness of electrical service, throwing in some choice bits of history and painting the wonders of the electrical age until he loses himself in a glow of oratory and sits down perspiring but happy in the thought that his enthusiastic remarks have advanced the electrical cause a long way and that increased receipts are as certain as the next sunrise.

Now it cannot be denied that a great many interesting things can be said after luncheon about the wonderful development of the electrical art, and every time electric service is mentioned some good results. But listeners at Rotary Club and similar gatherings are apt to be much more impressed by specific instances of what electricity is doing right in their own community than by too many generalities, and if the talk can be turned to constructive account all the better. Thus, in straightforward terms the speaker may tell his audience something about the development in connected mo-

tor load in the past two or three years resulting from the rate schedule not long since adopted, or he may cite a few actual costs in the use of electric cooking appliances, pointing out wherein these won the day over coal ranges and gas; or, again, he may suggest ways in which the electric company and the merchants can cooperate to secure a brilliantly illuminated town, transforming it into a live little city which everyone likes to visit.

If one of the big manufacturers has recently electrified his plant, let the diners be given a newsy account of what has been accomplished, and how the community gains by progressive service. In most cities of the enterprising type there is always some new school, hospital, shop, library or other structure newly completed or planned in which the very latest "wrinkles" in electric service are to be seen. Often in some little, remote town the first installation of some notable equipment representing an advance in design of interest to the engineering world can be drawn upon for popular description. By giving one's hearers a chance to share in the things that are doing and taking them into one's confidence a bit relative to things pretty well planned, the good results of an informal address can be much broadened, and friends of real value made and retained for the central station.

WOMEN AS ELECTRICAL WORKERS.

It is common knowledge that one of the consequences of the war in Europe is a large increase of female labor in electrical and other engineering factories. As the combatant nations call more and more upon their able-bodied men to relinquish the arts of construction in favor of those of destruction, this tendency becomes very marked. This movement was, however, making progress in the years preceding the war. So far as England is concerned, the statistics show that, whereas in 1901 out of a total of electrical workers numbering 49,518, 2,490 were women, the proportion of women had grown to 9,275 out of a total of 66,186 workers in the year 1911. The work covered included various operations in connection with cable manufacture, lamp-making, apparatus-making, etc. As part of an investigation instituted by a special economic committee of the British Association on the question of outlets for labor after the war, we have available an examination into the future possibilities in this connection. It is found that women are doing today in certain departments work which before the war was done by men, such as small-lathe work, screw-machine work, cable making, and the winding of transformers. The last-named of these occupations is regarded as an extension of work previously done by women, rather than as an entirely new process; for example, where they now wind two coils on a transformer they previously did only one.

The committee which investigated the matter consisted of three ladies. They say that it was the policy of many English firms before August, 1914, to extend the employment of women into new branches. That women have to some extent been replacing men, or at any rate entering new branches, may also be inferred from the fact that, though the electric-lamp branch of the trade has been depressed owing to the war, there has been a total increase in the employment of women in the electrical trade of nearly 18 per cent. Part of this increase is due to a temporary increase of production in branches of the trade in which women were previously employed, but women are to some extent taking the place of men who are away at the front. In most cases readjustment to meet the introduction of women has been simple, or no alterations at all have been necessary, as they have only been put at the lighter machine work. One firm has actually made the machines more mechanical and employs an extra mechanic as supervisor. It is usual when women are introduced into new processes for them to have a separate workshop.

The committee referred to states the main objections to the employment of women for electrical work thus: (1) want of technical skill and general experience; (2) want of physical strength, making it impossible to employ women on the heavier processes; (3) employers strongly object to men and women working side by side in this trade; (4) the men object to the introduction of women. In regard to physical strength, one firm found the women's output slightly less than that of men, owing mainly to exhaustion during the last hour of work. It is clear that as a general rule women's output is considerably less than that of men, since both on time and piece rates their wages are generally 50 per cent below those of men. The main advantages of woman's labor are found to be these: (1) their greater dexterity in certain processes where small fingers are an advantage; a noteworthy example is found in such processes as assembly work in the electric-lamp trade; (2) cheapness of their labor; (3) the larger supply of unskilled workers to draw upon.

It is considered that in those processes which are suitable to women, the possibilities of extending their employment are great. The employers do not anticipate any prospect of dismissing the women when the men return from the war. They in some cases expect not only to take back such men as return fit for such work, but to take on new ones as well, though the future state of trade naturally affects this prognostication. The men's unions, on the other hand, fear that the employment of women will both reduce the standard of wages for the men and lead to male unemployment also, after the war.

We have alluded to only one very small section of a most elaborate investigation which has been spread over many professions and departments of trade. The subject is one which will demand the closest study and attention in coming months, and perhaps years, at the hands of leaders of industry, leaders of labor, and social economists in Europe.

New Regulations Governing Export Procedure.

The announcement that new United States regulations relative to export procedure will become effective January 1, 1916, has created such intense interest among manufacturers and shippers that the Bureau of Foreign and Domestic Commerce, Washington, D. C., has found it necessary to reprint the new order with explanatory text. That pamphlet is just off the press and is being supplied free of charge to those interested, upon application to the above-mentioned office. All shipments for export to foreign countries or to Alaska, Hawaii, and Porto Rico will be affected by the new regulations.

Accuracy of statement and completeness of description in export statistics are the primary objects of the new procedure. Heretofore the data received by the Bureau of Foreign and Domestic Commerce have frequently been lacking in these respects, largely by reason of the fact that interior shippers consign to their agents at the seaboard for export, goods unaccompanied by adequate descriptions for use in making export declarations. The new regulations seek to remedy this defect.

The importance of detailed and accurate returns as a basis for the statistical information published by the Bureau of Foreign and Domestic Commerce is apparant when it is realized that the export trade of the country now exceeds $3,000,000,000 annually and is rapidly increasing. With practically all commodities participating in that growth, interest in commercial procedure is widespread and to meet the demand for authoritative instructions regarding the new requirements in export trade, the main features of Treasury Decision No. 35708, containing the regulations on that subject, have been summarized as follows:

1. A simplified form of shippers' export declaration has been prescribed, alike for exports by rail and by vessel. It is so drawn up as to prevent the disclosure of the value of goods to persons outside the customs service. The duplicate to be handed over to the shipper's agent at the seaboard or to the common carrier as proof of compliance with customs requirements will contain no statement of value.

2. The oath to shippers' declarations for export by water may be taken before any person authorized to administer oaths and not as heretofore exclusively before the collector of customs at the port of exportation. This will facilitate the preparation of export declarations by the original shipper instead of by his agent at the seaboard, who is less cognizant of the character and value of the merchandise and the country of final destination. Manufacturers themselves are urged to make out the export declarations wherever practicable, to assist in which work the Bureau of Foreign and Domestic Commerce cheerfully supplies to those interested Schedule B containing the official classification of all merchandise entering export trade.

3. The requirements on the part of common carriers have been somewhat simplified and hereafter copies of the waybills will be accepted from the railroad companies in lieu of car manifests. In vessel manifests a notation that the values are as stated on the shippers' declarations will be accepted in lieu of a detailed statement of the value of each shipment.

4. On an after January 1, 1916, the legal requirement that goods shall not pass out of the jurisdiction of the United States until shippers' declarations are presented in due form will be strictly enforced. Exception will be made only when the carrier gives bond to produce within 15 days export declarations (originals or duplicates) for all shipments.

Compliance with the new regulations will impose no hardships on exporters who have been observing the legal requirements. On the contrary their convenience is served, and the cooperation of shippers generally will aid the Bureau of Foreign and Domestic Commerce in publishing full and accurate information regarding the export trade.

Joint Independent Telephone Convention in Chicago.

An important epoch in independent telephony will be marked by the joint convention to be held in Chicago next week by the National Independent Telephone Association and the Independent Telephone Association of America. The latter organization was formed a few years ago by seceders, who did not approve of the policy of the old National Association. The directors of the National had already planned to hold its annual convention at the Hotel La Salle, Chicago, on December 8 to 10. At a recent meeting of the board of directors the directors of the Independent Telephone Association of America were invited to hold its annual gathering simultaneously and as a joint convention. This offer was accepted, and next week's assembly will, therefore, be notable as an unusually large gathering of independent telephone men and as marking the establishment of harmonious and friendly relations between the two associations, which doubtless will lead to their complete merger.

Exceptionally important problems are to be considered at the joint convention. Among these is telephone regulation, on which addresses will be made by members and engineers of the Interstate Commerce Commission and several state utility commissions. Management of telephone systems will be considered from several viewpoints. Telephone accounting will come in for much attention, also standards of apparatus.

Annual Dinner of Massachusetts Electric and Gas Association.

The twenty-sixth annual dinner of electric lighting interests in Massachusetts, with whom by invitation the gas interests of the state have recently become affiliated in a joint organization, occurred at the Copley-Plaza Hotel, Boston, Mass., November 22. President Charles L. Edgar presided. He referred to the organization of the Massachusetts Electric Lighting Association in 1889 by Frederick A. Gilbert and Everett W. Burdett, the latter having been associated with the organization as clerk and counsel for 26 years. By the inclusion of the gas men, an added representation of manufacturing interests aggregating about $1,000,000 in "balance of manufacturing account" has been secured.

There are in Massachusetts 53 electric companies, 61 gas companies, 19 persons, associations or corporations manufacturing or selling gas or electricity, and 22 combination gas and electric companies. "Balance of manufacturing accounts" of electric companies aggregates about $10,600,000, and of this $7,500,000 is included in the Association. Ninety-one per cent of electric companies, 25.5 per cent of gas companies and 77.5 per cent of combination companies in the state are affiliated with the organization. It is expected that a number of gas companies will soon become members.

Mr. Edgar alluded to the subject of the evening, "Taxation," as a burning issue, on which there is great haziness in the minds of business men. He looked with expectation of valuable results from the data which the Taxation Committee of the National Electric Light Association is preparing on the subject.

The speakers of the evening were Charles A. Andrews, former deputy tax commissioner of Massachusetts, and John J. Martin, president of the Boston Real Estate Exchange.

Special Lighting for State House.

The next Legislature of Massachusetts will be asked to authorize external illumination of the State House at Boston, either by means of flood lighting from concealed searchlights or a row of incandescent lamps outlining the entire structure, just below the cornice.

The Allegheny County (Pa.) Grand Jury has recently granted to the Borough of Turtle Creek permission to change its name to Westinghouse, in honor of the late George Westinghouse. Wilmerding and East Pittsburgh had also asked the same thing, but the jury refused their requests. Judge Brown suggested to the counsel of the several petitioners that it might be possible to incorporate the three boroughs into a third-class city.

Industrial Power Series—Article No. 146

ELECTRICITY IN ICE HARVESTING.

As the ice-harvesting season is approaching, attention is naturally being given ice-handling equipment by ice companies. The accompanying article describes an installation in a New England plant where electricity is used exclusively, and where, as a result, labor cost alone has been reduced $125 per day. Because of the short period of operation, the cost of a private generating plant is prohibitive. Central stations can well afford to investigate the opportunities for the sale of power in this field.

The use of electric motors has invaded the business of harvesting natural ice, which would seem to be one of the most primitive and rudimentary industrial operations known to modern life. The simple method of grooving and then plowing the ice field by the use of horses; then barring off the cakes and floating them to the apron and elevator at the ice house, by men ranged along the canal and armed with ice hooks, has been superseded at some of the important city plants of New England, by a method which not only economizes the labor of a large per cent of the working force, but also enables the crop to be harvested in a shorter time than formerly. The latter consideration is especially weighty, in that weather conditions have to be taken advantage of promptly or loss will result, and a possibility of missing the chance of harvesting the full quantity desired is incurred.

Last year the Walker Ice Company, of Worcester, Mass., adopted the improved method of ice-getting, with excellent results in the saving of time and labor. The present season the Waltham Ice Company, Waltham, Mass., is installing the same type of apparatus. The Dorchester Ice Company and R. H. White, of Taunton and Holbrook, Mass., are also operating this mode of ice harvesting the present season.

The machine for cutting ice by electricity is known as the Basin saw, manufactured by the Gifford-Wood Company, Hudson, N. Y.

The modern process of ice harvesting may be described briefly: First, the ice field of the pond or river is laid off by means of a float marker drawn by two horses. This machine divides the surface into sizes ranging from 14 by 16 to about 16 by 18 feet,

Motor-Driven Basin Ice Saws at Waltham Ice Company's Plant.

to constitute "basin floats," cutting a groove about two inches deep. These are deepened by the use of one to three ice flows, the depth of cut varying with the thickness of ice. The basin floats are barred off from the field and floated to the saw mill.

The floats are run through the first set of saws, which divide them into one dimension of the cakes desired, the float is given a quarter turn by men with ice hooks, and is sent through the second gang-saw, which gives the cross cut. Some companies cut cakes 22 by 44 inches, other 20 by 40, 28 by 44, 22 by 32 and 20 by 28 inches.

As the floats come from the second gang saw the cakes are barred apart and sent along a channel to the foot of the elevator. Formerly this operation was entirely hand labor, but now picking or driving machines, of which the Bond feeder is the approved mechanism, are installed over the channel, each in a shed to protect the motor and connections from the weather. The feeder consists of a revolving drum with spikes, which engage the surface of the ice cakes and keep them moving forward as fast as the apron of the elevator can take care of them. In modern ice houses electric motors operate the elevating apparatus and the horizontal runs.

The Walker Ice Company's plant at Worcester consists of two gang saws, one carrying eight and the other six 40-inch circular saws, installed across either end of a temporary covered shed about 60 feet long and 30 feet wide. The shaft on each saw is driven by a 35-horsepower induction motor installed on a raised platform on one side of the shed and centrally located between either end of the structure. A belt in either direction connects the gang-saw pulleys with those of a short shaft direct-connected to the motors, respectively, at about 18 feet between shafts.

The saws are set to cut about nine inches deep into the ice, which was about 14 inches thick last season. Both the sheet-steel frames which carry the saws are encased with a wooden hood which protects the saws from risk of accident and prevents the water and ice chips flying.

The Walker Ice Company operates two feeding machines, one of the Bond type and one of earlier home construction. The former is driven by a 7.5-horsepower induction motor, and the latter a 3-horsepower motor of the same type. The greater power requirement of the first mentioned feeder is due to its location at the lower end of the channel, where it forces forward the whole line of ice cakes.

The Walker Ice Company's elevator and gallery runs are now operated by a steam plant, but it is the intention to motorize this apparatus before another season.

Two 35-Horsepower Motors Driving Gang Saws at Walker Ice Company's Plant.

About 70 hours—7 days of 10 hours—are required to fill the company's house, which has a capacity of about 35,000 tons. The rate of wages paid the laborer is $1.75 a day in ordinary seasons. Last season the force consisted of about 210 men, 65 on the ice-field and basin-channel work, and 145 at the plant and in the houses. This represents a saving of the services of 65 to 70 men over the years before the motor-driven apparatus was installed—an economy of something like $100 to $125 a day for labor, or $700 to $875 for the season. The cost of power used in gathering the crop a year ago was $269.29, 7,278 kilowatt-hours, at the rate of 0.037 cent per kilowatt-hour. The company uses a certain amount of energy the year round, for which it pays 0.053 cent per kilowatt-hour. The consumption in 1914 was 22,559 kilowatt-hours.

Formerly about 25 horses were required for grooving and plowing the ice field into cakes; now only four horses are required. The risk of losing horses by drowning is greatly reduced; in 1912-13 the company lost four horses through the ice.

The four motors installed, aggre-

Horizontal Ice Run Operated by a 10-Horsepower Motor.

gating 80.5 horsepower, operate at a considerable overload. The Worcester Electric Light Company provides energy from its 220-volt, three-phase service. Carbon lamps on temporary installation from posts set along the channels, and also in the saw shed, enable work to be carried on after dark, thus shortening the harvesting season.

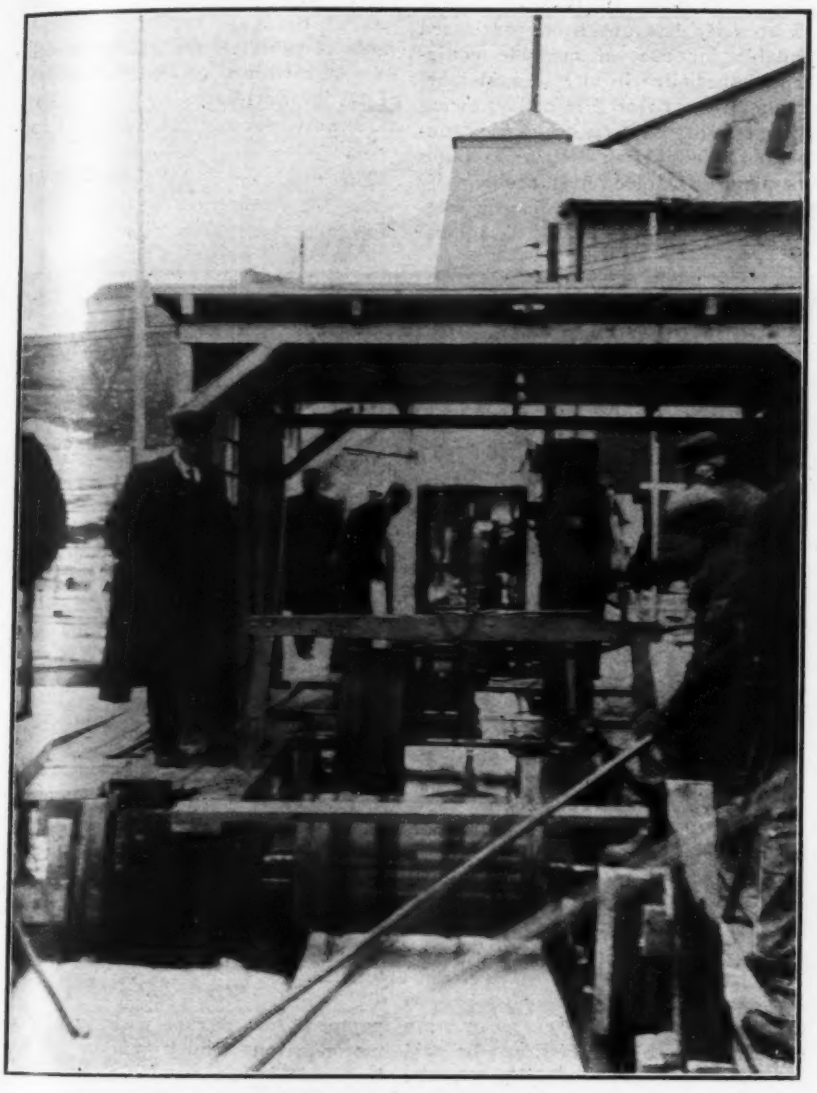
The Waltham Ice Company's houses are located on the bank of the Charles River at Waltham, just below the Waltham Watch Company's great plant, and in the closely-settled part of the city. Formerly ice was obtained from the river close by, but now, owing to the sediment and the cinders from the Boston & Maine Railroad trains near the river, the ice is unsuitable for use; hence the supply has to be taken from a mile to 1.5 miles up the river, where it is free from impurities.

A channel about 25 feet wide is cut from the ice-house landing to the field, and the floats are brought down the river, impelled by a tugboat.

The Waltham Ice Company's harvest is about 50,000 tons annually.

The Basin saw is installed in a 22 by 40 foot structure of southern pine timbers bolted together. The saws are 36 inches in diameter, the first gang in the channel carrying three saws and the second seven saws. The former are 44 inches and the latter 22 inches apart, to form a cake 22 by 44.

The gangs are driven by a 15 and a 35-horsepower induction motor, respectively. The two motors, one on each shaft, are each inclosed in a sheet steel box 3 feet 6 inches wide, 4 feet 4 inches long, and 3 feet 4 inches high, resting on the sheet-metal framework housing the saws. These frames are supported from the cross timbers above by chains which pass through pulleys and enable the apparatus to be raised or lowered to conform with the water levels and the requirements of the depth of cut in the ice. The Waltham company cuts about 8 inches deep, the ice being 12 inches thick.



Motor-Driven Basin Feeder.

From the basin in front of the second series of saws the cakes, barred apart, float along the channel to the apron and elevator, which is operated by a 35-horsepower induction motor located in a tower at the upper end of the elevating hoist, which it operates through gears. The motor also operates by rope drive a water pump to furnish flushing to a receiver for ice chips cut from the surface of the cakes.

The horizontal run, which connects the company's seven storage houses, about 225 feet in aggregate length, is driven through gears by a 10-horsepower induction motor installed in a wooden box near the initial end of the run.

Energy for operating all the motors is supplied by the Edison Electric Illuminating Company of Boston, on 220-volt, three-phase service. The rate is based on demand, and ranges from 10 cents to 5 cents per kilowatt-hour.

Electrical Prosperity Week in Boston.

Flood lighting of Massachusetts' historic State House, a parade of electric vehicles, and special activities on the part of the Boston Edison Company, which kept open house to the public at its 16 stores, were features of the Week at "the Hub."

The State House illumination was by means of 74 500-watt Mazda lamp projectors each equipped with a 16-inch reflector and giving a beam candlepower of about 100,000, or a total of 7,400,000 candlepower from all the units.

Thirty-eight of the projectors were located on the roof of the building at No. 6 Hancock Avenue, southwest of the State House, and 36 units were on the roof of No. 9 Park Street.

Hours of illumination were from dusk to midnight. The central location of the building, at the head of the Common and in full view of the business heart of the city, made for a conspicuous display, which was witnessed by thousands.

Electric cooking and washing apparatus were featured at all the Edison stores, including the appliance department of the main store, 39 Boylston Street. Tea and other electrically prepared refreshments were served to all callers.

The company's new two-cent rate was brought to the front in the demonstration of electric ranges, and it was claimed in connection with the display of washers that two cents' worth ef electricity will do the washing of a family of four to six.

On November 29 the Boston Edison Company mailed to its 80,000 customers a letter signed by General Superintendent W. H. Atkins asking for suggestions as to service, the courtesy and attention of employees, and ways in which the company could do more.

Commercial Practice
Management, Rates, New Business

Electric Range in College Dormitory.

An electric range of large capacity has been installed in Tower Court, the new central dormitory at Wellesley College, Wellesley, Mass.

The range is 12 feet long and comprises three ovens with inside working spaces, each 21.5 inches wide, 27 inches deep and 16 inches high; one flat three-section heated top 4 feet 6 inches long by 2 feet deep, three 18 by 24 inch rim griddles and three plug receptacles controlled by three-heat switches for connecting deep-fat frying kettles or other portable heaters.

The construction is of steel, with polished trimmings. Each heating unit has fuses and a separate three-heat control switch, and under each unit is a signal lamp under a ruby glass bull's-eye. The range is of Simplex manufacture.

The total connected load is about 35 kilowatts. This range, together with a Simplex electric baking oven serves 250 persons, steam being used for stock kettles and vegetable steamers. The energy used is from the Wellesley municipal supply which is obtained from the Boston Edison Company.

Taylor and Waco Now Connected by Electric Power Line.

On Wednesday, November 17, electric current from the big power plant of the Texas Power & Light Company in East Waco was sent as far as Taylor for the first time.

The transmission line which has been under construction for the past six months is practically completed and, although continuous service from Waco to Taylor will not be furnished for about ten days, in order to allow time for thoroughly testing out the line, the big job is done and an unlimited supply of power is now available for the sixteen cities south of Waco which will be supplied.

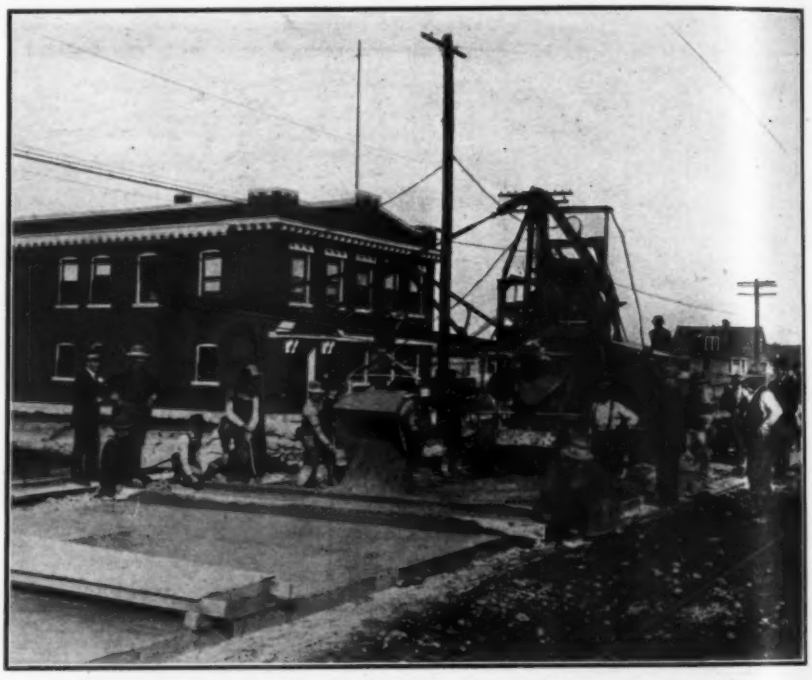
Temple, Belton, McGregor, Rogers, Moody, Heidenheimer, Eddy, Lorena, Bruceville, Troy, Holland, Bartlett, Taylor, Thorndale, Rockdale and Thrall will receive electricity from the Waco plant. Although the power stations at Temple and Taylor will be kept intact for emergency use, it is hardly probable that they will be needed because of the rugged type of construction used on the transmission line.

State of Utah Uses Electric Power in Road Building.

Electricity has not been considered available for use on movable equipment, especially if any considerable distance were covered in a day, owing to the expense of changing service connections. The Utah Power & Light Company has solved this problem by mounting portable substations on wagons for contractor's use. Each substation is equipped with 1,000 feet or more of secondary cable, which can be paid out as needed, thus supplying a range of 2,000 feet without a change in location of the substation. If the contractor has enough electrical equipment to warrant he employs an electrician to look after it who is also competent to make primary connections to the power company's lines.

The State Road Commission of Utah is using an electrically equipped tractor-concrete-mixer in the construction of six miles of concrete roadway between Salt Lake City and Murray. The roadway is 16 feet wide and 6.5 inches thick, and is laid on a rolled gravel sub-base which had previously been put in. A one-half yard mixer equipped with a 15-horsepower three-phase motor is used. Nine hundred and fifty lineal feet of roadway, requiring 305 cubic yards of concrete, are laid in an eight-hour day with a current consumption of 121 kilowatt-hours, or four-tenths of a kilowatt-hour per cubic yard of concrete.

The roadway is kept flooded with water for about three weeks after it is laid, and water for this purpose is pumped from ditches with an electric-motor-driven triplex pump. Three-inch pipe is run out for a distance of 1,500 feet on each side of the pump, and these furnish water for the mixer as well as for flooding.



Motor-Driven Concrete Mixed Used in Road Constuction Work. Fed from a Portable Substation.

Baltimore Stock-Selling Plan.

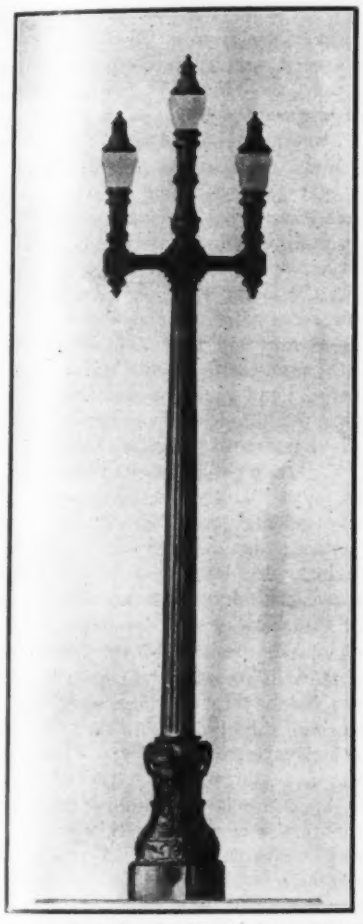
During the past month more than 100 names have been added to the list of stockholders of the Consolidated Gas, Electric Light & Power Company, of Baltimore, Md., through subscriptions to the common shares under the company's easy-payment plan. The company is selling the shares to its customers at the market price and subject to monthly payments of $4.00.

New Street Lighting for Salt Lake Business District.

The City Commission of Salt Lake City has formally declared its intention of installing ornamental lighting standards on Main Street, from South Temple Street to Fifth South, a distance of five blocks, or 3,960 feet. The proposed system contemplates the installation of 14 special standards to the block, seven on each side of the street, the distance between posts being approximately 100 feet. Each standard will be equipped with three 6.6-ampere inverted-type luminous arc lamps. The posts are of special design, as shown in the accompanying illustration, and are arranged to fit over the trolley pole, the bottom of the bracket carrying the lamps coming just above the point where the span wire attaches to the pole. It is the intention when this system is completed to require the removal of all other posts and poles from the curb, so that this special lighting system will be the means of substituting for the present trolley pole, unsightly at the best, a highly decorative standard and removing all other obstructions to the view. The height to the lamps will be 27 feet, and as the width of the street is 132 feet between property lines, the squatty narrow effect so usual where the lamps are mounted low will be avoided.

The cost of installation of the system is estimated at about $4.00 per front foot. This will be prorated under the provisions of the law, against the property included in the district, and will be collected as are other special assessments. The cost of maintenance and operation is figured at $1.30 per front foot per year. A portion of this expense will be borne by the city in lieu of the street lighting it is now doing, which will be replaced. The balance will be prorated against the property as is the installation cost.

The system was designed by W. D'A. Ryan, chief illuminating engineer for the Panama-Pacific International Exposition, who was specially commissioned by the property owners.



New Lighting Standard for Salt Lake City.

Buy Old Flat Irons.

The Texas Power & Light Company during Prosperity Week induced a number of local contractors in the towns where the company operates to take in old flat irons at 25 cents each, as many as two old irons being taken in on the purchase of a new electric iron at the regular price.

An Electric Range Campaign at Scranton.

The wide publicity which is being given electric cooking by manufacturers and central stations in many parts of the country is resulting in popularizing the electric range and attracting to it the attention and consideration which it deserves. Mention was made in our last issue of a campaign for this class of business recently inaugurated at St. Louis where 22 ranges were sold the first week.

In Scranton, Pa., a similar activity is under way and while it is too early to present results, the Scranton Electric Company feels that its efforts in this direction will be amply repaid. Supplementing a special campaign by personal solicitation the company is using considerable newspaper space, the accompanying advertisements being typical of the character of copy used. The Globe Stove & Range Company, manufacturers of the range featured in this campaign, assists the central station in every manner possible and furnishes copy for ads, literature, etc.

At the present time similar campaigns in which the Globe company and central station are co-operating are being held at Burlington, Ia., and Marion, Ind.

G
GLOBE
ELECTRIC
SAFE as a piano keyboard—
Baby fingers may twist at the switches of a Globe Electric as safely as they toy with the piano keyboard. There is no flame, no suffocating or explosive gas to flow out and fill the room. Nor are there dangerous matches lying around when, you cook with a Globe Electric.
Globe Electrics are safe, cleanly, convenient, handsome and economical. They bake, boil, roast, fry and broil—all that a range of any kind can do. Won't you let us demonstrate them to you? Any day—any hour—at our display rooms.
(ELECTRICAL COMPANY)
G
GLOBE
ELECTRIC
HEATS without fire—
The most efficient heat known—electrical energy—cooks the food in the Globe Electric Range. There is no flame—only heat. So carefully is this heat utilized and guarded in the Globe Electric, that the oven, heated in ten minutes, will maintain its baking temperature for two hours after the current has been turned off. Surely you know of no other such economical conservation of heat. The Globe Electric does all that any range will do and does it better—fry, boil, bake, broil or roast. Let competent demonstrators in our display rooms explain this and many other remarkable features of Globe Electrics to you.
(ELECTRICAL COMPANY)

Two Typical Advertisements Used by Scranton Company in Range Campaign.

Campaign Results in 110 Washing Machine Sales in One Month.

The Do-It-Electrically doctrine has struck Philadelphia and as a result during the month of September 110 housewives elected to have their washing done the electrical way, using Western Electric washing machines. These machines were placed in 110 Philadelphia homes as a result of a thorough sales and advertising campaign carried on during the month of September and covering the entire Philadelphia territory.

The campaign was conducted by the Philadelphia Electric Company, with the co-operation of the manufacturer, nothing being omitted to make the campaign a success. The driving wedge of the campaign was an easy-payment plan by which the machines could be purchased and which consisted of an initial payment of ten dollars and the balance in monthly payments of five dollars each; these were added to the monthly electric bills. This wedge was driven home by special folders inclosed in all light bills, by special one, two and three-column newspaper ads, car cards used in all Philadelphia cars, window displays and 30,000 special mailing cards. All advertising matter was printed from plates supplied by the Western Electric Company who also suggested copy and furnished window-display material, etc. The results obtained in proportion to the amount expended for advertising, were highly satisfactory to the Philadelphia Electric Company, who are planning a similar campaign for the spring.

Effective Plan for Interesting the Children in Electricity.

A novel contest is being staged this week in nineteen of the larger cities where the Texas Power & Light Company operates in the hopes of accomplishing several objects.

Only recently the company put into effect an electric cooking rate and one of the objects of this contest was to stimulate interest in electric ranges. One of the Hughes Jr. electric ranges is being given away to the little girl under fourteen years of age who guesses nearest to the number of beans in a lamp bulb which is hung in the show window. The beans are of different sizes and of different colors. The lamp bulb is sealed at the top and screwed into an ordinary socket.

The question "Do you use electric lights in your home?" is asked of all who enter and is one by which it is hoped to obtain some prospects for appliance sales and house-wiring.

On the back of the card issued to contestants are illustrated a number of household appliances. Spaces have been left under these appliances to fill in the proper names. Of course it is not expected that the children will know the names of these appliances and on this account they will in all probability take the cards to their mothers who will naturally become interested in the subject of "bean guessing" and electrical appliances. The newspaper advertising being done at this time is laying particular stress on the desirability of electrical gifts for Christmas presents so it will be seen that careful plans have been laid to take advantage of the interest created by the guess cards.

An illustration of the company emblem is shown on the card with the question "What company in your town does this emblem represent?" While this is an easy question it will nevertheless help to establish the "Service First" idea which is the basis of the company's business.

Electric Company's Show Window During Guessing Contest.

Rules of the contest have been printed on a window poster 11 by 14 and two of these posters have been placed in each show window. Children of employees of the company are not permitted to make guesses. The guess cards are numbered consecutively and in case there are two winning guesses the range will be awarded to the little girl who has made the earlier guess.

All the advertising that is being done appeals to the "playing house" mind of the children. The fact that the little range will cook as well as mother's big range is brought out vividly by having some little biscuits in the baking pan of the range in the show window. The superiority of this toy range from a safety standpoint as compared with the ordinary toy range with which matches are used is also brought out.

THE FUTURE OF ELECTRICAL ADVERTISING.

Need Shown for Specific Data on Results Obtained.

Speaking before the recent meeting of Ohio new-business men, W. A. Wadsworth, manager of the commercial department of the Union Light, Heat & Power Company, Covington, Ky., said:

"Present indications are that the time is not far distant when electrical advertising in some form will be considered generally as an essential to the success of any business. It is so considered by certain classes now. A striking example of this is the motion-picture theater. The statement was made recently by a prominent owner and operator that he had never opened a new house unless it was in direct competition with one or more other houses, and that he had used electrical advertising to successfully create and draw patronage from his competitors, with the result that he had never been obliged to close a house, due to competition, nor had he failed to drive out all competitors who did not follow his example and advertise electrically. The direct reason for this, he says, is that two theaters may be equal in every way and give equally good value, but if one is brilliantly illuminated and employs electricity generally as an advertising medium, while the other neglects this important feature, human nature will determine results.

"A merchant who for years had followed the practice of turning out his window lights when he closed his store was induced to try the experiment of leaving the lights burning until 11 o'clock every night for a month. It was necessary for the central station to loan the lamps and reflectors and donate the current for this period, but they were willing to do this as the merchant was located on a street of heavy night traffic and it was thought his example would be followed by his neighbors. As a result of this experiment the merchant bought the window-lighting equipment and placed his window lighting on a midnight schedule. Further than this, he employed some moving feature, usually electrically operated, in every window trim. He has completely remodeled his interior lighting, replacing gas arcs with nitrogen units, and has offered to use the best exterior electrical advertising suggestion made him that will not call for an expenditure of more than $500.

"Any central station that feels it is not in a position to carry on an extensive campaign for electrical advertising can certainly push window lighting.

"Probably one of the most important

reasons, and one for which we are responsible, why electrical advertising has not been making faster strides is the fact that we do not take the trouble to find out what results are obtained from this kind of advertising that is being done successfully and to use this information to encourage more advertising of the same kind among our customers. If the trouble is taken to inquire of our customers who have electric display, ornamental or decorative lighting, or who have properly lighted windows, or use electrical advertising in some other form, what results are being obtained, we would get enough data and ideas to start an active campaign for this kind of business. Incidentally, we would discover the dissatisfied electrical advertisers and have an opportunity to correct the fault that in nearly every case is the cause of their dissatisfaction.

"Electrical advertising is primarily night advertising. Night is an opportune time for advertising. People, during the day, are busy, their minds intent upon various duties. At night, with tasks of the day thrown aside, they are receptive to the influence of anything that catches their eye and pleases them. They read attractive advertising and heed its message.

"It is not, however, necessary to confine electrical advertising to night advertising alone, nor is it necessary to employ signs to successfully advertise electrically. Study carefully the window displays that have employed electricity to make them a success; investigate the moving effects employed not only by national advertisers but by local merchants to successfully carry out some selling campaign. Do this and tabulate the ideas involved and you will have suggestions and material upon which to build a successful electrical advertising campaign. There is no limit to the application of electricity for this purpose.

"If there be any of us who doubt the advisability of promoting electrical advertising, I am certain that the results of the efforts at present being made in connection with Electrical Prosperity Week will not only justify in such minds the wiseness of the campaign, but will result in getting their co-operation, which is one of the necessities for the successful carrying out of any united effort."

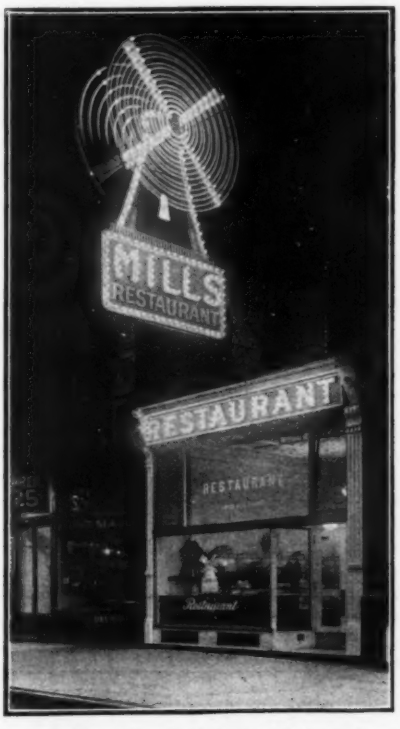
The Rutland (Vt.) Railway, Light & Power Company has offered twelve cash prizes to school children for the best essays on "Why Electricity is Our Best Servant."

The Salem (Mass.) Electric Lighting Company celebrated Prosperity Week by giving a coupon, good for $1 in trade before Christmas, with every $5 purchase.

New Electric Sign Attracts Attention in Cincinnati.

One of the most unique electric signs in Cincinnati, both in appearance and construction, is that designed and built for the new Mills Restaurant, and shown in the accompanying illustration. It carries out the trade-mark of the Mills restaurants, an old Dutch mill. The wings of the mill, in this case, are kept slowly revolving by a clever arrangement, with power furnished by a small electric motor.

The sign itself is one of considerable size, the tower of the mill being eight feet in height, exclusive of the base which bears the words "Mills Restaurant," and



Effective Electric Sign in Cincinnati.

is 4 feet wide by 8.5 feet long. The wings of the mills are over 9 feet from tip to tip. The word "Mills" is in two-foot letters, while the word "Restaurant," below it, is in eight-inch raised-wood letters, enameled, and illuminated by a surrounding border of electric lamps. The mill, with its wings, and the remainder of the sign, are outlined and illuminated by 395 16-watt tungsten lamps.

The structure weighs 900 pounds. It is constructed of metal throughout. The color is Dutch blue, with the border and letters in white, and the tiny window, the miniature fence around the base of the mill, and other decorative points also in white. The slowly-revolving wings of the mill, which run night and day, carry out the effect of reality admirably.

To obtain this effect no flasher device, of the ordinary sort, is used, the continuous slow motion required being obtained by a worm-gear drive. Starting with a 0.25-horsepower motor, with a speed of 1,700 revolutions per minute, it was necessary so to transmit the power as to give the wings a relatively slow motion, 7 revolutions per minute. This was done by gearing the motor to a pulley 1.5 inches in diameter, which in turn was geared to a 7-inch pulley on the worm shaft. This shaft is a heavy steel tube and communicates the power to the wings by means of a 2.5-inch worm-gear connected with a 10-inch wheel operating the wings.

The wings are lighted through the hollow shaft, by means of two brushes, insulated to the shaft, from which wires are run and connected to the wings. In this way the wings are kept moving at the desired rate, day and night, and at night are illuminated, with the rest of the sign, without difficulty. Five separate switches control the various parts of the sign, one controlling the motor which operates the wings of the mill, and one each the lights on the wings, the tower, the base, and the two words "Mills" and "Restaurant." A single master switch, of course, can be used to disconect the current from the whole sign, if desired.

A Useful Sales Help.

One of the first questions the average householder asks when a salesman tries to sell an electrical device is, "How much will it cost to operate?" The Twin State Gas & Electric Company of Dover, N. H., has installed in its showroom a device that will answer this question in a way that instantly attracts a customer. The company has had a seven-inch Westinghouse switchboard-type single-phase indicating wattmeter mounted on a small panel above a lamp socket, and both connected to its lines. The wattmeter has a black dial with white figures and pointer to make the readings stand out clearly, and has been calibrated in "Cents per Hour" instead of watts, based, of course, on the rate of 15 cents per kilowatt-hour in this case. Any heating device can be attached to this circuit, and the prospective customer gets an ocular demonstration of the "juice" it takes.

Flat Rates at Burlington.

The Burlington (Vt.) Electric Light Company is offering lighting at flat rates on the following schedule:

4	25-watt lamps,	$1.00 per month, net
5	25-watt lamps,	1.25 per month, net
6	25-watt lamps,	1.50 per month, net
7	25-watt lamps,	1.75 per month, net
8	25-watt lamps,	2.00 per month, net

For 60-watt lamps, which are supplied free, the charge is 60 cents per month per unit above four. For one flatiron, the rate is $6.00 a month. For the above rates a yearly contract is required.

The municipal light department, which is a keen competitor for business in the same field, has offered to meet the lighting company's flat rates, which, it claims, is a good proposition for the company.

Electrical Construction

HANDLING STORES ACCORDING TO THE CASH-CONTROL IDEA.

By Wilfred G. Astle.

Shortages in materials and supplies are just as expensive as shortages in cash and it is just as essential that one be guarded and accounted for as the other, because materials are but cash in a less fluid form and it pays to handle them as carefully. A piece of brass or copper in the storeroom costing and worth one dollar should be guarded and given the same degree of attention as a dollar bill in the office, and as C. E. Knoeppell says in "Maximum Production," a workman should have no more right to take this piece of brass or copper from the storeroom without accounting for it than he would have the right to walk into the office and remove a dollar bill from the cash drawer.

If there is no orderly method of looking after material in the storeroom there will always be a danger of serious and sometimes very costly losses. The principal sources of direct loss are wasteful use of materials and supplies, especially the latter; appropriation of material for private purposes, are out-and-out thievery. In a storeroom where workmen have free access to the materials, where standards of consumption are lacking, and when issuance is not thoroughly checked, there is bound to be wasteful use of materials and more especially the supplies; nevertheless, this tendency can be stopped by requiring a strict accounting for all materials and supplies that are issued. In the average instance, what one man appropriates for his own private use in the course of a year does not amount to much; nevertheless, it is just because he takes this view of the matter, without any particular scruples, he continues the practice until he comes to consider that he is only taking what is his right. Thievery, in the average instance amounts to very little, although it all depends upon the character of the stores. Articles of small bulk but high value, such as copper and brass, in the form of wire, which is easily concealed about the person, and which find a ready market as junk, constitute a temptation to which even the highest grade workman will sometimes succumb. Proper storekeeping and accounting methods will, however, put a permanent stop to these troubles.

One of the greatest sources of indirect loss is a lack of standards of consumption and of rigid control over issuance, which means the carrying of a larger stock than is actually necessary. This in turn amounts to a wasteful employment of working capital and interest on the excess investment and also a heavier depreciation on materials, which is a direct charge against profits. By controlling the supply statistically, it is possible to keep the quantity on hand on all items at all times close to the minimum, and to gradually exhaust any materials that a contemplated alteration in the design of the product will make unnecessary; so that when the old style is dropped the dead stock will be practically nothing. Another source of indirect loss is the production delay on account of shortages. This source, although less tangible, nevertheless is one of the largest negative factors in the problem. To eliminate shortages, which is one of the most detrimental in its effect upon production efficiency, is worth all the time, energy and money required to improve the control of stores. Still another source of indirect loss is the lack of centralization, which means the using of valuable space about the factory for storages, which might be more profitably used for production purposes.

The first step that should be taken, to eliminate these sources of direct and indirect losses, is to consolidate all the materials and supplies in one or more centrally located storerooms, to close them off from the rest of the factory, and place a storekeeper in absolute control with instructions that no material is to be given out under any circumstances except by the authority of a written order duly signed by the proper person. The storekeeper should be a man exceptionally well qualified for the position, and must, above all things, be exacting, and have such

PERPETUAL INVENTORY RECORD

Symbol _____ Description _____ Balance on hand should never exceed _____

Unit _____ Location _____ When balance on hand sinks to _____

Price _____ _____ Requirement _____ Put in order for _____

PURCHASE ORDERS					RECEIPTS			DISBURSEMENTS								
PURCHASE ORDER NO.	DATE	VENDOR	PROMISED	QUANTITY	RECEIPT NO.	DATE	QUANTITY	DATE	QUANTITY	BALANCE ON HAND	DATE	QUANTITY	BALANCE ON HAND	DATE	QUANTITY	BALANCE ON HAND

Fig. 1.—Stock Record Suitable for Perpetual Inventory System.

complete control over the men in his employ that the slightest infraction of rules will mean the equivalent to a final check. He should also be capable, conscientious, and a man who will appreciate the value of the materials he handleds and be full alive, at all times, to the responsibility of protecting the company's property. He should be familiar with the materials, and know their uses, but it is not necessary that he should be a skilled mechanic.

A suitable system of filing and indexing all stores should be provided. There should also be a definite place for every class of material, and that class should always be kept in that one place. The question of the size and weight of the material, and the frequency with which it will be called for, should be the first consideration in storing. The bins and racks should be arranged so that the storekeeper can tell at a glance how his supply is holding out. If, in addition, the arrangement can be made to show automatically when the low limit has been reached on any item, so much the better. The storekeeper should systematically check up his accounting by taking a physical inventory. A good time to do this is when the balance or any article reaches its low limit, and this should always be done; but it is also well to check up a certain number of items every day in regular turn, so that each item will be inventoried at least once a year, but oftener if possible. No merchant would neglect to inventory his cash on hand at the close of each day's business, regardless of how much confidence he placed in his cash register and in those who used it. Therefore, it should be just as necessary for the manufacturer to keep close tab on his balance of materials, for these are, as already stated, only cash in a less fluid form.

A large electrical company in New York City, in caring for its supplies by means of a perpetual inventory system, has made it very simple by dividing the stock into classifications as follows:

Classes 1 to 10—Wiring and underground supplies.

Classes 11 to 25—Arc-lamp parts, incandescent lamps and light hardware.

Classes 26 to 39—Steam fittings heavy hardware, and automobile supplies.

Classes 40 to 45—Station operating supplies and overhead material.

Form 401

The Toronto Electric Light Company, LIMITED

Goods received by Stores Department

From

BAGS BUNDLES REELS

BARRELS COILS

BOXES CRATES

WEIGHT CAR NO. WAY BILL

191 A

Order No.

Via

Charges

QUANTITY	DESCRIPTION	HOW USED: LOT NO	WORK ORDER	ACCOUNT NO.

IMPORTANT

Full details of all Shipments received must be given above, and this form sent to Audit Dept. within 24 hours after receipt of goods.

Received by

Correct

Fig. 2.—A Form of Receiving Report—Actual Width 8.5 Inches.

Classes 46 to 49—Reels and carboys.

Classes 50 to 100—Cable.

These different classes are cared for by means of the perpetual inventory as follows:

February 28—Inventory material in classes 1 to 20.

April 30—Inventory material in classes 21, 26, 27, 28, 29.

May 31—Inventory material in classes 22 to 25.

August 31—Inventory material in classes 30, 31, 32, 34, 39, 40.

October 31—Inventory material in classes 41, 44, 45.

December 31—Inventory material in classes 33, 43, 49, 50 to 100.

Therefore, a physical inventory of the storeroom material is carried on constantly in one division or another and is checked against the stock ledger balances. The officials have also made provision for suitable sections, bins and drawers in their several storerooms, all so arranged as to be readily found and easily accessible, and each bin is also tagged with the name of the material stored in it.

They also have what they call a "flying inventory squad." Their storerooms are scattered over the city and the squad goes into each of the district storerooms and checks up the material in the several classes just prior to the inventory date. This is in addition to the regular check which is carried on constantly by the district storekeepers themselves, so that they are in touch with the situation at all times. This company carries approximately 8,000 items in its supply account, and this system of checking has been adopted with a view to making leakages, if not impossible, at least too difficult to be often attempted. This can be done only by means of perpetual inventory with its far-reaching advantages over the old system of making a physical inventory once a year.

These perpetual inventories require perpetual attention. The difficulties in handling them have been largely due to lack of attention on the part of employees. There are some very simple rules that should be noted. (1) No material should be permitted to leave the storeroom without a requisition, signed on behalf of the department where it is to be used. (2) All requisitions must be checked up each night before closing and for that purpose an hour should be established in the afternoon, after which all requisitions of the day should be held over and filled the first thing in the morning. (3) Low-limit marks should be established by which the storekeeper can be protected, and the purchasing agent can be warned of the possible exhaustion of the supply. (4) A large low-limit mark should be placed on each kind of raw material so that the purchasing agent may have sufficient time to get new estimates before ordering a new stock of material. (5) Perpetual inventory records should be treated as cash is treated. Cash is verified often, or should be; so the inventory should have regular periods of verification.

The faithful operation of a perpetual inventory record, although involving considerable clerical work, gives the manufacturer perfect control over his stock issuance, and for this reason alone is worth every penny it costs. Moreover, if the balances on hand are systematically checked with the actual balances, there is no need to close down once or twice every year for the purpose of taking inventory. Instead a clerk can go through the records and

in a few hours, or a few days at the most, obtain the desired information. Finally, in case of a fire, the evidence of an up-to-date stock record furnishes an indisputable basis for insurance adjustments on that element in the valuation.

It is evident that all this is good business policy. No manufacturer would think of issuing checks against an unknown bank balance nor if he found his accounts-payable at any time likely to exceed his cash account, would he delay to make provision for an adequate supply when the critical due-date arrived. Therefore, why should he not be just as provident as to the adquency at all times of his stock supply?

A theoretical stock record system may be outlined which would afford a perfect record, but, when put into practice, it might prove unsatisfactory, or it may be too expensive for the protection afforded. A practical test is always advisable before a decision is made upon a stock record system for any business. The installation of such a system calls for the exercise of judgment of the highest order. These records may be kept either in ledger or card form. There are good points in favor of each, but a list of items which ought to be a part of every stock record, are the name of article, description, part number, aisle number, bin number, unit of stock, date of receipt of material, name of concern from whom purchased, cost per unit, amount received, amount drawn from stock, order number on which withdrawal is made. So far as an actual record of the stock received and disbursed is concerned and the balance on hand, the above will suffice, but the real value of a record of this kind lies in the possibility of being able automatically to keep at the proper level, which can be done by the addition of a few more items—normal stock, minimum stock, maximum stock, amount ordered, balance due. The stock record clerk is then responsible for the ordering of stock at the proper time. Fig. 1 shows a form of stock record.

The normal stock should represent the quantity that would be sufficient to supply the demand for a certain period, or number of units to be manufactured, with due regard for the period of time necessary to obtain more stock of the same kind. If this is raw material, and is purchased in some distant city, the average length of time the material would be in transit, as well as the possibilities of prompt delivery to the cars by the concern from whom it is bought, must be fully considered in establishing a normal stock quantity. The minimum simply serves as a low-limit mark and the maximum as a high limit.

All items posted to stock records, both receipts and disbursements, should be taken from forms made out by responsible employees and checked; otherwise they will not reflect the true status of the stock on hand. Another reason why extreme care should be taken with these records, is that, in case of discrepancies between the records and actual stock on hand, they cannot be accurately corrected. Therefore, separate forms should be used for each receipt of stock and for each requisition that comes from the plant. Never post from oral information.

The records should be checked periodically by the results obtained from an actual count; and in case of errors, either by overage or shortage, the record should be made to agree with the actual amount on hand after the cause for the discrepancy has been determined. Unless checks are made and the reason for discrepancies ascertained, the records cannot be relied upon. Much care should be taken to keep the stock records in balance with the stock on hand as is taken by the cashier to keep his cash in balance with his cash book. If you wish to justify yourself for making the necessary expenditure to cover the installation and maintenance of a system to keep track of your material, or if you feel inclined to consider it "red tape," just stop to reflect that material represents money and whether or not you would be satisfied to fill your storeroom with gold dollars and keep no record of their ultimate disposition. You don't do it in your office; why do it in the storeroom? One surely must admit that the cases are parallel.

Material, under no circumstances, should be received through any channel except the receiving department, as any other course surely will lead to endless mistakes and trouble. This department is usually one in name only, as it is customary to have the receiving and shipping done by the shipping department, in all except the larger organizations. In such cases the shipping department simply makes out a receiving report in duplicate, showing the number of boxes, barrels and crates received. The duplicate copy of this report should be retained by the shipping department and filed according to the date the material is received, or alphabetically according to the name of the concern from whom the material was obtained. Such a routine will insure in all cases a correct record of receipt. The original should be sent to the proper storeroom or department, attached to the material. With this arrangement the material is not opened in the shipping department. Their receipt is merely evidenced by the making out by the clerk of a receiving report.

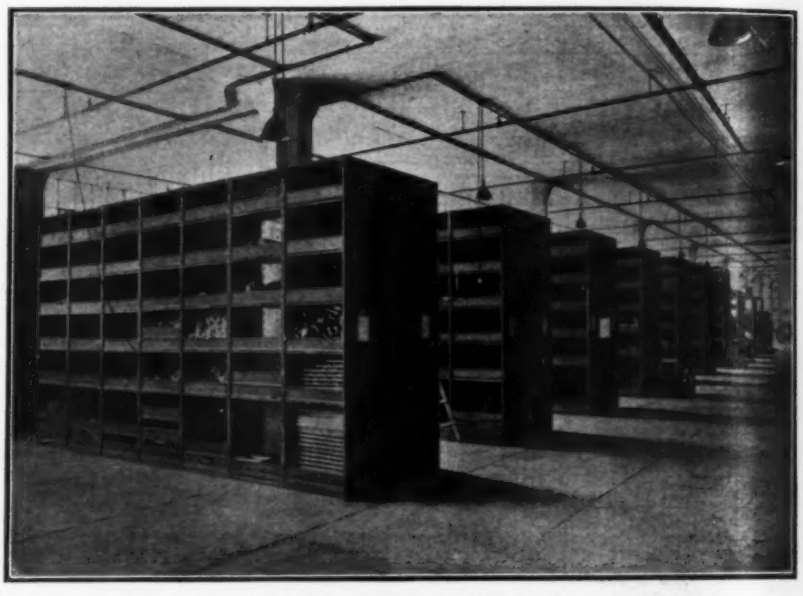


Fig. 3.—Steel Adjustable Shelving in the Plant of Continental Motor Manufacturing Company, Detroit.

This plan as outlined has three excellent features: (1) Inasmuch as all material would necessarily have to be verified, after reaching the storeroom, by counting and checking, the same operation in the receiving department amounts to an exact duplication of work with the incident additional cost of labor involved. (2) The opening of the material in the shipping department would require additional floor space and benches, which is duplicated in the storeroom. (3) Material if opened in the shipping department is more liable to be stolen in transit to the storeroom, or lost.

Nevertheless, there is one particular advantage gained by maintaining a

regular receiving department where materials are inspected, counted and weighed, as soon as received. It furnishes an additional check on receipts which, in cases of disputes with outside concerns as to amounts delivered, furnishes the most reliable evidence that reasonably can be obtained. This plan also satisfies the management that materials received are being properly accounted for by two distinct departments. In the last analysis too much cannot be said for the double check, when its cost of maintenance is not out of all proportion to its value.

All material, whether checked and counted in the receiving department or not, eventually has to be handled by the storeroom receiving clerk. In the first place, the storeroom should contain a section devoted exclusively to receiving. All material delivered to the storeroom receiving clerk should be counted, weighed, gauged or measured by him and the date noted on the receiving report, together with a proper description of the material. This verifying should be done, where possible, the same day the material is received, and in no case should it be delayed to such an extent that the non-receipt of the receiving report by the accounting department will cause the loss of discount on bills. Fig. 2 shows a form of receiving report.

Fig. 4.—Steel Equipment in Storeroom of Davis Milk Machinery Company, Chicago.

In handling material and supplies of all kinds the cash-control idea should always be kept in mind, and the workmen should all be imbued with the same idea. The storerooms should always be locked, so that all stores will be under lock and key and issuance made only on the "O. K." of a responsible foreman, because it is a well known psychological truth that the sense of value is inversely proportioned to the ease of obtainment. By this it is not meant that issuance should be surrounded with safeguards and restrictions so as to put the workmen to inconvenience in securing necessary materials, but on the contrary, this should be facilitated as much as possible and the wasteful use of materials and supplies, especially the supplies, should be discouraged absolutely.

To accomplish these ends, it is very essential that standards of consumption should be adopted, otherwise, it will not be known when restriction becomes a nuisance and a loss. When the management of any business is in such a commanding position that they are able to say with force "this is your allowance—for any excess we must know the reason in every case," the workmen's sense of value assumes its normal; and the proper degree of carefulness in the use of materials and supplies will follow. Then, and then only, does maximum economy in consumption result.

Wisconsin Electrical Contractors to Meet.

The thirteenth annual meeting of the Electrical Contractors' Association of Wisconsin is to be held at the Hotel Wisconsin in Milwaukee, on January 17 to 19, inclusive. An interesting program is in preparation. The open session will be held on the afternoon of the second day of meeting, Tuesday, January 18; this will be followed that evening by the annual banquet. The secretary of the association is Albert Petermann, 626 Lloyd Street, Milwaukee, Wis.

A Common Fallacy.

For the past number of years the electrical contracting business has appeared attractive to many journeymen as a means of entering into business for themselves, and it has also appeared attractive to others who are not connected with the business in any way. There seems to be a disposition on the part of the general public to assume that there is enormous profits in this business and that the electrical contractor is more or less an extortionist. This opinion is shared by many who are closely identified with the business, namely the journeyman. From outside information, such as is generally gathered by those who are not in immediate touch with the detail of the business, they are led to believe that the difference between the cost of labor and material and the price which is obtained by the contractor is profit. In the course of time a workman gets a fair idea of the cost of material and it is then an easy matter for him to make a close estimate of the cost of the labor, based upon his experience as a workman. Considering these two elements only, it appears to the average workman that the man he is working for is making a tremendous profit on the goods he is selling.

This is a common fallacy, not only among the journeymen electricians, but also among the customers of the contractor. Those who are only permitted to take a casual view of the contracting business practically from the standpoint of an outsider overlook a most important element of all business and especially a business where any labor is required in the sale or installation of material, namely overhead or operating expense. Viewing the electrical contracting business from the angle of the workman or general public, it can readily be understood how such wrong impressions should prevail in the minds of the uninformed. However, when we stop to consider, when we get into the very heart and soul of the business, when we enter into the intricate detail, we find lurking there a parasite which is so easily overlooked by the casual observer and which is in fact so elusive as to deceive those who have the opportunity of being in close touch with the details of the business. This parasite is ever present. It is there eating away the profits everyday, sunshiny days, rainy days, days when business is good, days when business is poor. And it is this unseen and often misunderstood item which is not considered by the journeymen and the customer, and it is quite natural, understanding nothing of this item which represents in most instances the larger proportion of the cost, that the contracting business should appear attractive.

This animal, overhead, is found in every crack and crevice of the business. It is found in the office, in the workshop, it is found in rent, office salary, stationery

and supplies, it is found among the tools and other property in the form of depreciation. It is found out on the job in various forms. It sometimes appears in the form of lost time, due to human inefficiency of the superintendent or the men under him. It is among the men in the form of time lost in beginning and quiting work. In the automobile it rides about, in upkeep and depreciation. It travels about with the collector and presents itself in the form of allowances made to customers in the settlement of their accounts. It is ever present with the office force in inefficient methods. It is a daily and hourly companion of the manager. It will be found to be lurking in the books of the concern in bad accounts as well as in accidents in the business which causes unusual and unexpected expense. It will be found in the carelessness of employees is not properly caring for the property of the owner. It is found everywhere and it is this animal, overhead, which often times devours not only the entire profit but the original investment and leads the contractor to bankruptcy.

When I hear a contractor say that he has no overhead, I often wonder how much salary he would ask me to conduct a similar business. You can depend upon it that he would immediately become valuable as a manager and I therefore contend that if he is valuable as a manager in my employ, he then has an overhead and is valuble to his own business. He is unwilling to render service to me as an employer without good compensation, but in business for himself we often find him rendering this same service to his customers without pay.

How many contractors in considering the item of overhead expense give the matter of business insurance any consideration? They carry accident insurance on themselves, fire insurance on their property, automobile insurance on their cars, for the purpose of reimbursement in case of accident. They do not carry accident insurance upon themselves because they believe that if they should sustain an accident, which is liable to occur, that the accident will be less painful or that by carrying accident insurance that they are less liable to sustain an accident. No, they carry accident insurance for the purpose of reimbursing themselves for any unusual or unexpected expense occasioned by an accident which may occur. Accident insurance is carried on oneself to protect the earning power. If it is reasonable to carry accident insurance on yourself, fire insurance on your stock, or automobile insurance on your car, then you should for the same reasons carry insurance on your business, to reimburse you for any unusual or unexpected expense occasioned by an accident in your business. Every business firm should set aside a certain amount each month or year to be considered as accident insurance and this should be considered an item of overhead. Such accident may not occur for months or years but when it does occur you will have an amount which will cover a part if not all of the unusual and unexpected expense and it will not be necessary to take this expense from the profits of your business as it has been added to the cost of labor and material in estimating contracts or it has been added to the cost of material sold over the counter or which enters in to time and material jobs performed by the contractor.

It is my contention that if a person or a firm poses as a contractor and announces himself in business either by the word of mouth, advertising literature, or otherwise they immediately incur an overhead expense. If a person was to enter into business tomorrow as an electrical contractor and let us say for sake of argument that he did not rent a place of business, supposing that it was an individual who was a bachelor and had no residence and to make the point more clear suppose he was living at home with his parents at their expense and suddenly became enthusiastic over the imaginary profits occurring in the contracting business and entered the field as an electrical contractor. The first step this individual would take would be to have some cards printed, which is an item of overhead expense. Just the moment he even decides to enter the business he creates two items of overhead expense. One printing and stationery, the other manager's salary. Just as soon as he obtains his first job he creates an overhead expense in laying out the work and from that time on he meets this animal, overhead, at every turn of the road. Notwithstanding the fact that he may not recognize it in many phases of the business where it may appear, it is there and this has been conclusively proved by the fact that a very large per cent and in fact nearly all of the men entering the business who have not properly considered this business companion, overhead expense, have failed in business.

G. W. Hill.

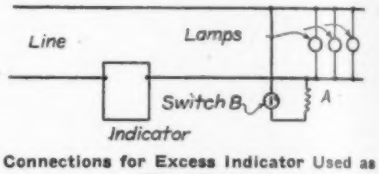
Excess Indicator for Fire Alarm.

A novel application of an excess current indicator was called to the writer's attention some few days ago. In a large manufacturing plant, the operators were frequently unable to hear the fire-alarm gongs on account of the noise of the machinery, and consequently would not always respond promptly during fire drills, which were given at regular intervals as required by law.

To overcome this difficulty and provide a thoroughly reliable signal the red lamps kept continually burning, to mark the various exits of the buildings, were wired up on separate circuits controlled by an excess indicator. The mechanism of this device consists of a magnet and a special double-break switch mounted upon a cast-iron base which also forms the back of a casing much similar in design to that of the ordinary watt-hour meter. This magnet and switch are connected in series with one side of the circuit, as shown in the accompanying diagram. When a load in excess of that for which the indicator has been set is put on the line, the operation of the mechanism causes all of the lights controlled by the indicator to flicker. This action continues until the excess load is removed.

In this particular installation the extra load required is provided by the resistance *A* controlled by the switch *B*. In case of fire, or for fire drill, this switch is closed, throwing the resistance directly across the line, causing the indicator to operate. The flickering is instantly evident over the entire building and gives a positive warning which was not possible with the fire gongs.

In using this system care should be taken to select a resistance which will not overheat if left in the circuit for any length of time. Further, the resistance should be substantially mounted.



Connections for Excess Indicator Used as Fire Alarm.

Probably the best method is to use a resistance unit with Edison screw base which will fit any standard receptacle. Lamps could be used instead of the resistance, but the latter is more reliable and not easily broken. Only a small resistance unit is required, as the indicators will respond to an excess demand of 10 watts on a 100-watt load or an overload of 10 per cent on higher loads. The indicators can be supplied in capacities up to 10 amperes for either 110 or 220-volt direct or alternating-current circuits.

This scheme gives a comparatively inexpensive and effective signal arrangement and one which is not likely to get out of order. It will probably be more largely used as it becomes better known. It is also well to note that this system could easily be interconnected with any fire-alarm system by using a suitable circuit-closing relay instead of the hand-operated switch at *B*. The indicator for this particular installation was of the type manufactured by the Pittsburgh Electric Specialties Company.

George A. Schneider.

Electricity has been a big factor in cheapening water supplies for towns and cities, and its employment is rapidly growing.

Dollar Wiring Kinks.

Every reader is invited to contribute to this column. It does not matter how few words are used to explain a "Dollar Wiring Kink," provided the idea is made clear; and if a diagram is necessary, a rough pencil drawing will serve. The idea itself must, of course, be new and bright. A dollar will be sent to the contributor upon publication.

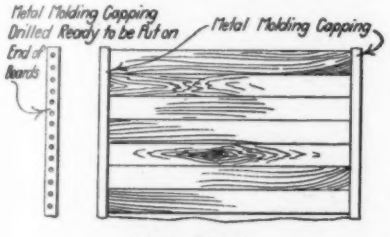
Fixture Tool.

A great help for a wireman who has to hang new fixtures is to solder a brass ferrule on a solid die to act as a guide, and he needs no stock. This makes a handy tool to run over the gas pipes on ceilings before hanging fixtures; it also is useful on the bench or in the tool bag for ordinary use.

Ben R. Browne.

Meter Board.

In making meter boards I always use the scrap pieces of metal molding capping on the ends of several boards



Meter Board.

whose lengths are cut to the width I want it to be. Take the capping and drill it so two nails will catch each board, then put it on the end and nail. Then I have a good solid meter board. Four screws will hold the board in place, size 24x30. The larger the board the more screws can be used to hold it in place.

O. S. Livergood.

Keeping Decorations Clean.

When on a recent job, I had occasion to bore holes, many times in the corners of the rooms. As my hands were, naturally, dirty, and I should probably get the wall and decorations dirty if I touched them, I used my handkerchief. By passing the end under my right thumb, and holding it there by the pressure of my hand on the head of my brace the handkerchief went across the knuckles and back of my hand. The other end of the handkerchief covered the hand working the brace, by going across the back and being held in place by the thumb and little finger. It is rather a bother, but it works, and I did not get any decorations smudged up.

Harold Allen.

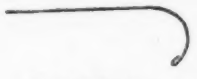
Snake End.

I find it desirable to bend the end of my snake as described below, and in that form it will go through any run of flexible conduit. About two inches from the end I give the snake a longitudinal quarter turn. At the extreme end it is bent into the form of an eye or a ball. I have used this form of snake with great success.

William P. Ullrich.

Curl End of Snake.

When fishing wire in conduit, the steel snake which is inserted first, always hits the inside of the box at the



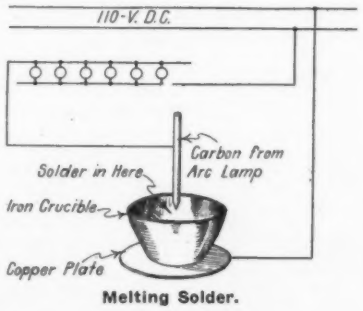
End of Snake.

other end, and must be pulled out by the helper. By curling the end of the snake as shown in the illustration, the snake can be pushed through and out of the box, so that if there is only one ladder at hand, the helper can reach the snake from the floor.

J. H. Lamoureux.

Melting Solder.

The accompanying illustration shows an arrangement I have used for melting solder in small quantities in a crucible, where it is all ready for dipping joints or the ends of stranded wire. An arc-lamp electrode is connected in series with a bank of lamps on a 110-volt direct-current circuit and brought in contact with the solder, which has been placed in an iron crucible connected to the other side of the circuit. After striking the arc the electrode is held a short distance away from the solder and the heat which is generated will



Melting Solder.

melt it very quickly. I find this more rapid and more satisfactory than using a torch.

William T. Estlick.

Holder for Soldering Paste.

By filling an old D. & W. fuse case with soldering paste, it can be carried in the tool bag very conveniently. When in use reverse ends with the case and screw it into top part and it will stand on end any place to suit the convenience of the user.

H. W. Hatch.

Twisting Wires.

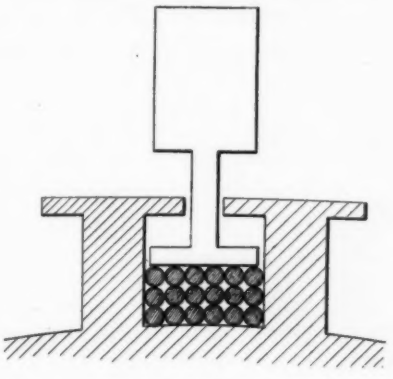
For twisting single wires together take electric, hand, breast or brace drill and chuck one end of each single wire in same. Fasten the other loose ends firmly to a nail or other object to keep them from turning. Turn drill until wires are twisted as required. Insulated wires should not be twisted too much, as the insulating covering will crack.

Each single wire should be several feet longer than the twisted length required.

Frank C. Petersen.

A Coil Drift.

When winding coils into partly closed slots of armatures or stators the wires tend to build up and fill the slot before the required number of turns have been wound on. To force the wires to the bottom of the slot under such conditions a fiber drift was made as shown in the sketch. The web of the tool



Coil Drift.

should be made as short and thick as possible to give the maximum strength. The slot insulation is not shown.

A. Hearvey.

Center of Ceiling.

To find the center of a ceiling not over twenty feet square I use the following method. A bit extension is clamped near the center of an extension rule. I set the step ladder approximately in the middle of the room and holding the bit extension in one hand, measure the ceiling. Much time of moving the ladder about and looking for faint marks is thus saved.

In measuring the ceilings of low rooms the rule is clamped at its middle and the extension used as a handle; a feeler bit is held in the other hand and used as a marker. When the center is found the bit is used to make a distinct mark.

A. R. Steinhaus.

The power station at Studley College, England, is in charge of a 20-year-old girl. It includes a gas engine, dynamos and storage battery.

Public Service Commissions

Conducted by William J. Norton

CALIFORNIA.

The Sacramento Gas Company was authorized to create a bonded indebtedness of $1,500,000 first-mortgage six-per-cent bonds, and to issue and sell $400,000 of these bonds at not less than 92.5 per cent face value.

DISTRICT OF COLUMBIA.

Jacobus Kappeyne will succeed H. C. Eddy as engineer of the Public Utilities Commission of the District of Columbia. He is to serve as both engineer for the Commission and valuation bureau chief in bringing to completion the work of valuing the properties of the public utilities in the District.

PENNSYLVANIA.

The Midvale Power Company applied for a certificate of convenience and necessity permitting the company to furnish electric service in Jenkins Township. The Citizen's Electric Illuminating Company filed a protest alleging that it is furnishing adequate service in the township and that the approval of the application would mean the duplication of facilities in a locality where only one company can subsist. The Commission finds that the present company is able to furnish adequate service, and is also financially able and willing to build and install additional facilities to meet any future demands for power; that the existing company has given fair and adequate service in the township for a long period of years; and that under the evidence, there is no public necessity for a new company. The application is dismissed.

The Philadelphia & Reading Railway Company refused to furnish passenger service over a certain branch road, alleging that the furnishing of the service would result in a heavy loss. The Commission holds that, "even though a railroad suffers some incidental loss in furnishing adequate facilities, a public service company may always be required to perform its charter duties to the public."

The White Oak Light, Heat and Power Company. A complaint filed with the Commission by the White Oak Light, Heat and Power Company, alleged that the Borough of Benson was about to construct an electric light plant and compete with the company in the supply of electric service in the Borough. The complaint raises the question of the right of the municipality to construct a plant to furnish street lighting service and to supply commercial service where a private plant is already established. The complainant had formerly furnished street-lighting service under a contract with the Borough. It appears that the service was unsatisfactory and the Borough would not enter into a new contract when the old expired. The complainant has continued to furnish electric service to private consumers. The Borough has entered into a contract with the Penn Electric Service Company by which the company is to furnish electric current to the Borough and its inhabitants, and has provided facilities for the distribution of this current. The Commission has been asked to approve this contract. The Commission holds that the Borough of Benson, under the circumstances in this case, should not be authorized to acquire or construct a plant for furnishing electricity to the public unless it should acquire the plant of the existing company; but, that the approval of the Commission to the construction by the Borough of a plant for furnishing street lighting was not necessary. The contract between the Borough and the Penn Electric Service Company is approved.

Foreign Trade Promotion Through Strong Organization.

A corporation to develop American export trade has been organized in New York City with a capital of $50,000,000, the leading figures being men well known in the electrical industry. It is proposed to issue $49,000,000 in common stock and $1,000,000 in managers' shares. The organization will be known as the American International Corporation and Charles A. Stone, head of the firm of Stone & Webster, has been elected president, and while not severing his connection with the engineering organization, will devote all of his time to the new enterprise. R. P. Tinsley, treasurer of the Standard Oil Company, is secretary and treasurer of the new company.

The board of directors is composed of Charles A. Stone, Stone & Webster; Theodore N. Vail, American Telephone & Telegraph Company; Frank A. Vanderlip, National City Bank; Albert H. Wiggin, Chase National Bank; Edwin S. Webster, Stone & Webster; William L. Saunders, Ingersoll-Rand Company; Percy A. Rockefeller, Standard Oil Company; Otto H. Kahn, Kuhn, Loeb & Company; James J. Hill, Great Northern Railway Company; Charles A. Coffin, General Electric Company; Joseph P. Grace, W. R. Grace & Company; William E. Corey, Midvale Steel & Ordnance Company; Ambrose Monell, International Nickel Company; Henry S. Pritchett, Carnegie Foundation; Robert S. Lovett, Union Pacific Railroad Company; Charles H. Sabin, Guaranty Trust Company; Beekman Winthrop, Robert Winthrop & Company; James A. Stillman, National City Bank; John D. Ryan, Anaconda Copper Company; J. Ogden Armour, Armour & Company.

Fig. 1.—Redlands Concrete Post.

Some California Types of Street-Lighting Standards.

A study of electric street lighting in the towns of southern California discloses the use of a number of ornamental posts which are not only attractive in themselves, but which in some cases have a peculiar local significance. The accompanying illustrations show a number of designs which

Fig. 2.—Alhambra Post.

Fig. 4.—Riverside Post.

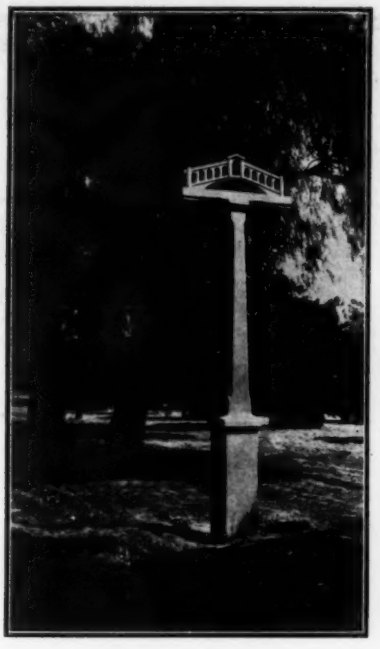


Fig. 6.—Upland Post.

have been utilized in connection with tungsten incandescent lamps. Much originality has been shown in the novel design and ornamentations of some of these posts.

Fig. 1. shows a unit which is in use in Redlands. This is a concrete post characterized by simplicity, dignity and beauty of design.

Fig. 2 shows a type used in Alhambra, which is known as the "Crescent City." The idea involved in this name has been applied in the design of the lamppost, where the individual lamps are mounted in crescents. The upper part of this post is iron, while the base is of concrete. Fig. 3 shows another post in this town. One of the lamps here is supplied with a red globe of frosted glass and indicates a fork in the road.

Riverside is known as the "Arrow City" and here again the designation finds application in the lamppost. This is shown in Fig. 4. The cross at the top of this post and the bell-like white-glass reflectors are typical of the old Spanish missions of this place.

Fig. 5 shows a unit which more accurately represents an arrowhead, however. This post is used in San Bernardino. Fig. 6 shows a concrete model which is in use at Upland. This post is pleasing in appearance, but shows poor design in providing no protection or diffusing glass for the bare lamps.

Fig. 7 shows an iron post used in Pasadena. The number painted upon the globe in this case has a peculiar significance. In Pasadena many of the houses are set well back from the street, with a parking in front, and considerable shrubbery and trees, so that it is difficult at night to see the house number from the roadway. The number shown on the globe of the lamppost is the same as the street number of the house in front of which it stands, and this constitutes a point of considerable convenience, especially for those using automobiles.

Fig. 3.—Post with Red Globe.

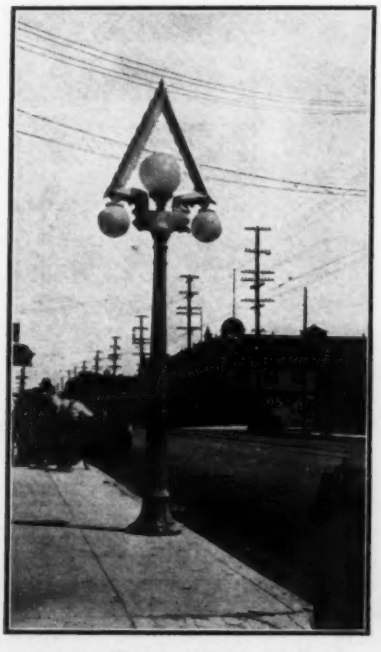


Fig. 5.—Post in San Bernardino.

Fig. 7.—Post in Pasadena.

TESTING FOR GROUNDS AND INSULATION RESISTANCE.[1]

By L. H. Henderson.

Accidental grounds on wiring or distribution systems are likely to occur in spite of all precautions. In practically every electric wiring or distribution system there are certain conductors which should normally be free of all connection with the earth, that is, free from grounds. In installing such systems every reasonable effort is ordinarily made to prevent the connection—accidental or otherwise—between the system and the earth. Such connection may occur directly between the wiring system and the earth, or it may be due to the contact of some member of the wiring system with a conductor which connects with the earth. Thus porcelain or glass insulators should be used to support conductors away from the surface on which they are carried or from adjacent objects, and porcelain tubes are used where the conductors pass near pipes or through walls or partitions. Furthermore, rubber-insulated conductors only should be utilized in concealed locations. In conduit work, rubber-insulated conductors are used to prevent the grounding of these conductors on the metallic conduit system, which is itself connected with the earth.

However, in spite of all these precautions electrical conductors which should be normally insulated from ground sometimes make contact with it. These accidental grounds may occur where insulated wires have become displaced or lie against damp walls or timber, or against some piece of metal work which is in contact with the earth.

Ordinarily one ground on a wiring system will produce no adverse effects but if another ground occurs on the other side of the system (that is, on a conductor of the opposite polarity), then a short-circuit will result and interruption of service and fire may possibly follow.

The Function of a Ground Detector.

It is obvious then that it is always desirable to keep a system entirely free of grounds. The function, therefore, of a ground detector is to indicate when a ground occurs on a system so that it may be cleared immediately.

Low-voltage ground detectors may be divided into two general classes: Incandescent-lamp detectors, Fig. 1, and voltmeter detectors, Fig. 2, *II*. Each of these types will be briefly discussed in the paragraphs which follow.

Ground detectors should, as a rule, remain continuously in circuit, because if they are so arranged that they may be cut in and out of circuit it is quite possible that one ground may occur on the system and not be noticed until another ground occurs on a wire of opposite polarity, in which case a short-circuit, with the attendant dangers outlined above, might result. It is for these reasons that ground detectors employing incandescent lamps are, where their application is feasible, probably better than a voltmeter ground detector, because ordinarily the lamps can be so connected that they will remain continuously in service, whereas voltmeter ground detectors are usually so connected that they are switched in and out of circuit.

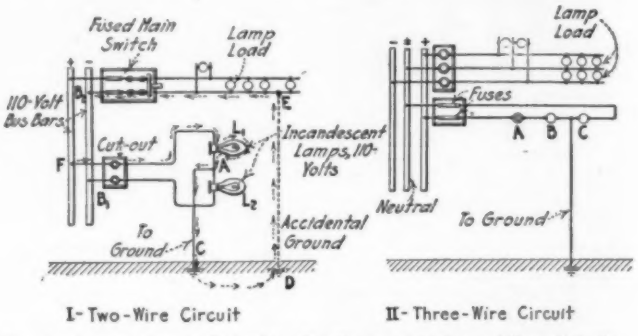


Fig. 1.—Lamp Ground Detectors for Two- and Three-Wire Circuits.

Lamp Detectors.

The principle of the incandescent-lamp ground detector is illustrated in Fig. 1, *I*, which shows the connection for the simplest possible arrangement. Note that two lamps, L_1 and L_2, are connected in series through a cutout across the busbars or across some portion of the distribution system which the ground detector is to protect. From point A between the two lamps, a permanent ground connection is made to C. Obviously, since the two lamps, L_1 and L_2, are connected in series across the busbars, current will flow through them and the lamps will burn. If two 110-volt lamps are used in series, as shown in the illustration, half the normal current will flow through them and hence both of the lamps will burn dimly.

Now assume, for example, that an accidental ground occurs at any point, E, on one of the negative wires of the wiring system with which the ground detector is associated. Then there is a conducting path from the positive busbar to the negative busbar, as shown by the dotted arrows, that is, from F around to B_2. Now, if the accidental ground is of reasonably low resistance, the effect is that the lamp L_1 is connected directly between the positive and the negative busbars, and hence will burn at practically full brilliancy. It should be noted that incandescent lamps have relatively high resistances. For example, a 16-candle-power, 110-volt lamp has a resistance of about 220 ohms. Now, the path *ACDE* really constitutes a low-resistance shunt around the high-resistance lamp L_2, so that practically no current will flow through it and it will not give out light.

Hence with a ground on one of the negative wires of the wiring system, the ground lamp connected directly to the positive busbar will burn brightly and the lamp connected to the negative busbar will go out. If a ground occurs on the positive side of the system, the lamp connected directly to the negative side of the system will burn brightly and the other one will go out. If the accidental ground on the system is of high resistance, the

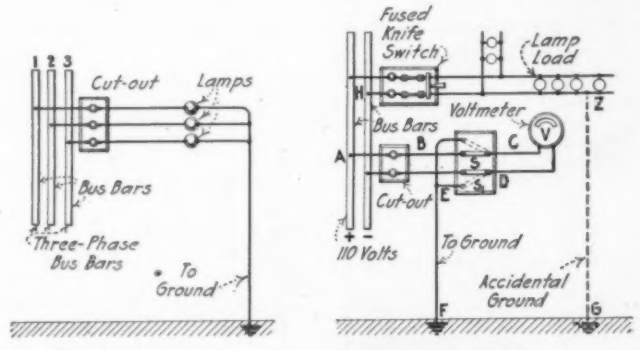


Fig. 2.—Three-Phase Circuit and Voltmeter Ground Detector.

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lamp L_3 will not be extinguished entirely but may burn dimly at an intensity proportional to the resistance of the ground. The principle thus outlined is the general one upon which practically all types of lamp ground detectors depend for their operation.

Two-wire-circuit lamp ground detectors can be arranged substantially as shown in Fig. 1, *I*, for either direct- or alternating-current circuits.

A three-wire-circuit lamp ground detector is shown in Fig. 1, *II*. With the circuits arranged as shown, if a ground occurs on the negative leg of the system, all three lamps, A, B and C, will burn brightly. With a ground on the neutral conductor of the system lamp C will be dark and A and B will burn dimly. With a ground on the positive leg of the system, C will burn brightly, but A and B will be dark. Lamp A may be mounted on the back of the switchboard or in some location where it is not visible, inasmuch as with only lamp B and C visible the attendant will be notified of grounds on the system. For a 125-250-volt three-wire system, use for A, B and C three 110-volt lamps. For a 250-500-volt three-wire system, use three 220-volt lamps.

A lamp ground detector for a three-phase system is shown in Fig. 2, *I*. The lamps are connected in star, one lamp between each of the phase conductors and ground. If a ground occurs on any phase-wire the lamp connected to that wire goes out and the other two lamps burn brightly.

Voltmeter Detectors.

Voltmeter ground-detector connections are shown for a two-wire circuit in Fig. 2, *II*. By changing the position of the switch S the voltmeter may be connected across the busbars of the system, thus indicating the station voltage, or it can be connected between either of the busbars and ground. Assume, for example, that the voltage between the busbars is 110, and that an accidental ground Z occurs on the negative side of the system. Then with the lower switch lever in the dotted position S_1 and the upper switch lever in the position shown, the voltmeter will be connected by the accidental ground directly across the buses. Current would flow through the voltmeter by way of the route A B C V D S_1 E F G Z H. Therefore, if the resistance of the accidental connection ZG were very low, the voltmeter would read 110 volts. If the resistance of the accidental ground connection were high, the voltmeter would indicate a correspondingly low reading. Thus it is possible to estimate the resistance of an accidental ground from the reading of the voltmeter connected as shown.

For example, assume a voltmeter which has a resistance of 10,000 ohms gives a reading of 100 volts when connected across a 100-volt circuit. Then if this same voltmeter gives a reading of 50 volts when connected in series with an accidental ground across a 100-volt source, it is evident that the total resistance in this circuit must be twice the resistance of the voltmeter itself, or 20,000 ohms. Obviously, then, the resistance of the ground is 10,000 ohms. Other values may be computed by using the method of proportion just indicated. A schedule can be tabulated from these computations indicating the resistance of a ground for certain scale deflections—say 5 volts apart—of the voltmeter.

The general directions which should

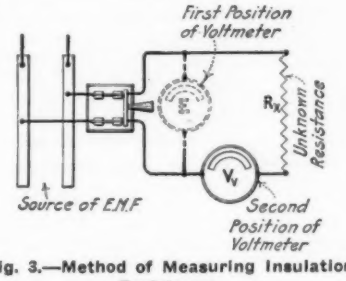


Fig. 3.—Method of Measuring Insulation Resistance.

be followed in installing lamp ground detectors are as follows: A keyless lamp receptacle should be used. Switches should be omitted from the detector circuit. The detector lamp circuit should be protected with fuses. The ground lamps should be within an inch or so of each other so that differences in their brilliancies may be readily visible.

Ground-detector ground wires should not be connected to gas pipes for the reason that there is always a possibility of a ground connection carrying a

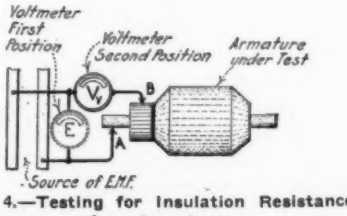


Fig. 4.—Testing for Insulation Resistance of an Armature.

heavy current which might ignite the gas and cause a fire.

Continuously indicating detectors are in some localities required for all circuits. For example the Factory Mutual Insurance rules specify that ground detectors of the continuously indicating type will be required on all ungrounded systems for voltages below 250. For voltages greater than 250, continuously indicating detectors which do not permanently ground the system (electrostatic ground detectors for example) are recommended and in some cases may be required. Electrostatic ground detectors can be obtained for operation on circuits of almost any commercial voltage. Obviously, lamp ground detectors are not applicable to circuits operating at voltages exceeding, say, 500. Voltmeter (non-continuously indicating) ground detectors are in many cases used for circuits operating at voltages above 500, but the electrostatic detector is obviously the safer and more desirable.

Insulation Resistance.

The insulation resistance of a wiring system or of a piece of electrical apparatus is the resistance between the conducting portion of the system of apparatus and the earth. Inasmuch as the metallic frames of electrical machines and devices are, after the apparatus is installed, in electrical contact with the earth, the insulation resistance of such a device is ordinarily taken as the resistance between the conducting portion of the device and the metallic frame.

Although the conductors in a wiring system are supported on so-called insulators and the windings of electrical machines are "insulated" from the metallic frames thereof, it should be remembered that there is no such thing as a perfect insulator, and that all substances are electrical conductors to some extent. Substances that we call insulators are such poor electrical conductors that almost no current flows through them. Although the resistance of insulators is extremely high, it can be measured quite readily, as can the insulation resistance of a wiring system, or of a piece of apparatus. If the insulation resistance of a wiring system to ground is very low we say that the system is grounded. If the resistance of the winding of an electrical machine between conducting portions of the windings and the metallic frame is low, we say that the machine is grounded. Hence the term "low insulation resistance" implies a heavy ground on the system or apparatus in question. It is obvious that it is desirable to maintain the insulation resistance of a system at a high value, that is, to keep the system free from grounds. In accomplishing this desirable end it is very helpful if tests for insulation resistance are made periodically.

The instruments for measuring insulation resistance are many. Certain special types, such as the ohmmeter and the megger, are frequently used. The Wheatstone bridge is often applied in this work. For many cases in practical work the most convenient instrument is an ordinary voltmeter, which can be readily utilized as shown in Figs. 3, 4, 5 and 6.

The theory of the voltmeter method of measuring insulation resistance is as follows: When the same current

flows through two conductors in series, the volts drop across each of the conductors will be proportional to the resistance of the conductor. Then with an unknown resistance R_x (Fig. 3) connected in series across the source of electromotive force as shown, the volts drop across R_x will be proportional to its (unknown) resistance. Furthermore, the volts drop V_v, across the resistance of the voltmeter, as indicated by the reading of the voltmeter itself, will be proportional to the resistance of the voltmeter. It follows then that a proportion can be written, thus:

$$V_v/V_x = R_v/R_x \quad \ldots\ldots (1)$$

Solving for R_x, the unknown resistance, the following formula results:

$$R_x = R_v V_x/V_v \quad \ldots\ldots (2)$$

wherein, V_x = the drop across the unknown resistance, R_v = the resistance of the voltmeter in ohms. The resistance R_v of the voltmeter is known, and the drop across the voltmeter V_v can be read from the instrument and is therefore known. Now V_x can be ascertained by subtracting from the electromotive force, E (impressed across the voltmeter and the unknown resistance in series), the voltage drop across the voltmeter (see Fig. 3).

$$V_x = E - V_v \quad \ldots\ldots (3)$$

Then substituting this value in (2) the resulting formula is

$$R_x = R_v\ (E—V_v)/V_v \quad \ldots\ldots (4)$$

The above is the working formula used in measuring high resistance with a voltmeter. Its application is illustrated below.

First, measure the voltage E, Fig. 3, available for the test. The source of this electromotive force may be any that will remain reasonably constant while the test is being made and that will give nearly a full-scale deflection of the voltmeter used. A direct-current generator, a storage battery or, in certain cases, a primary battery can be used. Second, a voltmeter, the resistance of which must be known, is connected in series with the unknown resistance across the electromotive force E, and the reading V_v that the instrument then gives is noted. Knowing the values of E, V_v, and R_v, the resistance of the voltmeter, these values may be substituted in formula (4) and the unknown resistance computed. It is not necessary to use the same voltmeter for taking the reading E and the reading V_v, although it is desirable to do so. A high-reading instrument can be used for ascertaining the voltage of the source and a millivoltmeter for the determination of the V_v value. Where the insulation resistance is very high the deflection with the voltmeter at V_v may be so small that it cannot be detected.

The resistances of voltmeters are usually high. Frequently the resistance of an instrument is marked by the manufacturer in the cover of the case containing it. If the resistance is not thus indicated it will be necessary to either measure the resistance of the instrument with a Wheatstone bridge or by some similar method, or to write to its manufacturer, giving him its serial number, for the information.

Example.—With the apparatus connected as shown in Fig. 3, using a direct-current lighting circuit as a source of electromotive force, the readings were as follows. The voltmeter, when connected as at E to measure the impressed voltage, read 105 volts. When connected as at V_v in series with the unknown resistance, it read 3.2. The resistance of the voltmeter as ascertained from its manufacturer was 20,000 ohms. What was the resistance in ohms of the unknown resistance?

Substitute in the formula:

$R_x = R_v \times (E—V_v)/V_v$

$= 20{,}000 \times (105—3.2)/3.2$

$= 636{,}300$ ohms.

Armature insulation resistance may be measured with a voltmeter as suggested in Fig. 4. In taking these readings the voltmeter is first connected across the source of electromotive force and is then connected in series as shown. One of the leads to the armature, A, is connected to the shaft, while the other, B, is connected to one or all of the commutator bars of the armature. That is, the voltmeter is connected to the source in a circuit comprising (1) the voltmeter itself, (2) the conductors of the armature, (3) the insulation of the armature from its shaft and (4) the shaft of the armature. The insulation resistance of the armature and that of the voltmeter are so great as compared with the resistances of the other components of this circuit, that the resistances of these other components may be disregarded.

Example.—In measuring the insulation resistance of an armature, a voltmeter having a resistance of 10,000 ohms was used. The voltage of the source was 108. With the voltmeter connected in series, it read 0.8 volts. What was the insulation resistance of the armature?

Substitute in the formula:

$R_x = 10{,}000 \times (108—0.8)/0.8$

$= 1{,}340{,}000$ ohms.

The method of measuring the insulation resistance of the stator windings of an electrical machine with a voltmeter is illustrated in Fig. 5. The procedure is much the same as that described in connection with Fig. 4. One lead from the source of electromotive force connects to the conducting portion of the stator windings of the machine, while the other lead from the source is connected, but through the voltmeter, to the frame of the machine, thus placing the voltmeter in series with the insulation resistance.

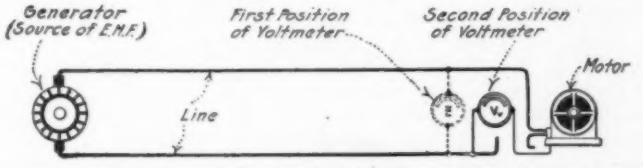


Fig. 5.—Testing Insulation Resistance of Motor or Generator Between Winding and Ground.

The measurement of the insulation resistance of a wiring system can be made as shown in Fig. 6. The voltmeter is first connected across the terminals of the source of electromotive force (in the case shown a generator is used), giving the reading E. Then one terminal of the source is grounded and the other is connected through the voltmeter to the electric wiring system. The almost infinitesimal leakage currents impelled by the source would flow through the volt-

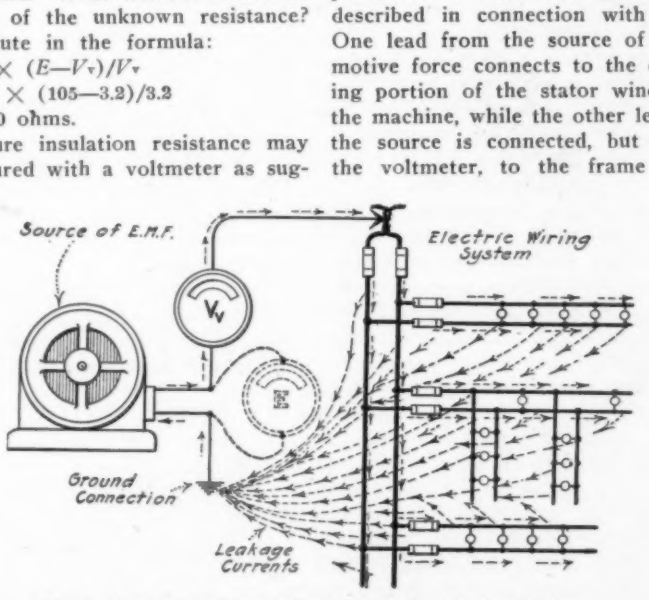


Fig. 6.—Testing Insulation Resistance of a Wiring System.

meter, through the wiring system to ground, and back to the source, somewhat as indicated diagrammatically in Fig. 6. As noted in Code Rule 88, the insulation resistance of wiring systems is very high. No difficulty whatever is encountered in satisfying the requirements of this Rule 88 if the Code rules are followed.

Example.—A voltmeter having a resistance of 2,200 ohms is used to measure the insulation resistance of a wiring system. The source produces a voltage, as shown by the reading of the instrument, of 115 volts. When connected in series with the wiring system and ground, the voltmeter reads 0.5 volt. What is the resistance of the system?

Substitute in the formula:

$R_x = 2{,}200 \times (115—0.5)$

$= 503{,}800$ ohms.

Stream Measurements in the North Atlantic Coast Drainage Basins.

The measurement of streams was begun by the United States Geological Survey in 1888, and since 1895 the appropriations by Congress for the Survey have each year included an item for gauging the streams of the country.

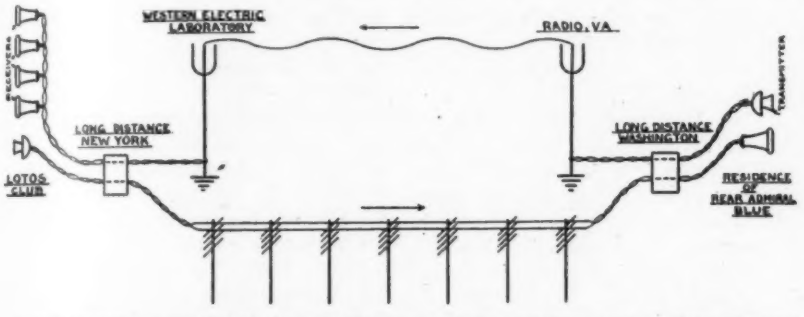
A report on the North Atlantic coast basins, just issued, represents the results of co-operative work between the Federal Survey and the states of Maine, Vermont, Massachusetts, and New York in 1913. It gives the results of investigations of the streams that enter the Atlantic from St. Croix River, Me., to Rappahannock River, Va., which discharges into the lower end of Chesapeake Bay, and includes also the measurements of flow of St. John River, which reaches the ocean through the province of New Brunswick. The records includes descriptions of the stations at which the measurements were made and tables of gauge heights and daily and monthly discharge.

The report is published as Water-Supply Paper 351 by the U. S. Geological Survey, Washington, D. C.

HONORING JOHN J. CARTY.

The Chief Engineer of the American Telephone and Telegraph Company, Guest of The Lotos Club, New York.

The Lotos Club, of New York, famous on two continents for its entertainment and recognition of men of distinction and achievement, gave a dinner and reception, November 7, 1915, in honor of John J. Carty, whose recent work in organizing and completing long-distance telephoning between New York and San Francisco and wireless telephoning from New York to Hawaii and to the Eiffel Tower, Paris, is well known to every reader of the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN. Three hundred and twenty members and guests gathered at the Club House on Fifty-seventh Street, New York, and extended a cordial and enthusiastic greeting to their fellow member, Mr. Carty, who in responding to the tribute paid him by President Frank R. Lawrence, of the Lotos Club, and others, insisted that great credit should be given to his associates in the wonderful developments the year 1915 has brought in telephone science. In the course of his interesting remarks Mr. Carty stated that there were 500 men of science on the engineering staff of the American Telephone and Telegraph Company—a larger number it is believed than any university has in its faculty.



A photographic reproduction of this diagram was presented to each of those present at the dinner at the Lotus Club, New York, on November 27, to John J. Carty, chief engineer of the American Telephone and Telegraph Company. The diagram represents the wire and ether connections between the Lotus Club at New York and the radio station and residence of Rear Admiral Blue at Washington, D. C. The telephone conversation from New York to Washington was over the wire line and the conversation was transmitted through space from Washington to New York. Every word that came via wireless was clearly heard and understood in New York.

Mr. Carty emphasized repeatedly his appreciation of the work of the engineering staff and mentioned particularly Messrs. Gherardi, Jewett, Colpitts, Arnold, Heising, Englund, Blackwell, Osborne, Robinson, Stevenson, and a number of others who took a prominent part in the work.

With regard to the further use of the ether as a medium for telephone intercommunication, Mr. Carty suggested that the use of the wireless would be supplemental to the use of the wire system rather than supplanting it. The greatest use of the wireless would be to establish contact from ships at sea and points not accessible by wire lines to shore stations. As the service of the wireless extends, the use of the ether will undoubtedly have to be restricted to serve those who have no other means of intercommunication available. As the instruments are properly developed and get into wider practical use, this single conductor, the ether, must be reserved to serve in cases of emergency those who have to depend upon this sole means of establishing communication.

A demonstration of the excellent working of the transcontinental telephone line from New York to San Francisco, with a roll call of leading cities between, was given. The members present had a watch-case receiver at their plates and easily heard all that was said. Greetings were exchanged between President Lawrence in New York and President Frank P. Deering of the Bohemian Club, in San Francisco. There was given in addition, a demonstration of wireless telephony between New York and Washington, Mr. Carty and others talking through the ether with Rear Admiral Victor Blue at his residence in the National capital.

Hon. Josephus Daniels, the Secretary of the Navy, was one of the guests of the club, and talked with the admiral from his seat at the guests' table. Others at the head table were: President Theodore N. Vail, of the American Telephone and Telegraph Company; Samuel Insull, Captain William H. G. Bullard, U. S. N.; Colonel Samuel Reber, U. S. A.; Frank J. Sprague, Union N. Bethell, Melville E. Stone, John P. Gavit, Chester S. Lord, and Charles W. Price. There was a large attendance of electrical members of the Lotos Club and their guests, among whom were: T. Commerford Martin, N. C. Kingsbury, B. E. Sunny, H. B. Thayer, Angus S. Hibbard, Thomas D. Lockwood, Frank H. Bethell, Thomas B. Doolittle, Cyrus O. Baker, W. P. Bowman, John R. Carty, H. Durant Cheever, Bancroft Gherardi, H. A. Halligan, E. T. Holmes, F. B. Jewett, George T. Manson, Walter Neumuller, F. A. Pickernell, A. L. Salt, C. E. Scribner, Gerard Swope, John I. Waterbury, H. J. Pettingell.

Telegrams and letters were received from Prof. Alexander Graham Bell (from his country place, Cape Breton, N. S.). Thomas A. Edison, Hon. Lindley M. Garrison, Secretary of War; and Gilbert H. Grosvenor, editor of the *National Geographic Magazine*, who said everyone connected with geography greatly appreciated "the wonderful work of Mr. Carty." Mr. Edi-

son's telegram from his laboratory at Orange, N. J., was addressed to Mr. Carty and said: "I am sorry I cannot be with you tonight to congratulate you in person on the great achievement of yourself and your engineers in the transmission of high-rate complex electric waves over great distances. May your powers never grow less."

At the end of the demonstration the wireless time signals sent from the chronometer at Washington, D. C., to all ships and elsewhere were heard on all the telephones and then followed the wireless weather reports.

Secretary Daniels, Mr. Vail, Dr. Sprague, Captain Bullard, Colonel Reber, Mr. Bethell and Mr. Gavit spoke of the interesting and valuable work of Mr. Carty.

Mr. Vail said: "I cannot refrain from saying a few words in appreciation of this most delightful and considerate tribute to the foremost genius in electrical personal intercommunication—Our Carty. We, that is, all of us associated in that organization called the Bell System, associates who act and think and work together, are very proud of our Carty and are honored by anything that honors him.

"When our Carty was born electrical science was in its swaddling clothes, still being nursed in the laboratories of scientific institutions.

"There were a few, who were looked upon as dreamers, outside these laboratories trying to teach the art how to walk and work—were trying to develop its industrial activity. Such men as Bell, Edison, Brush, Thomson and many other now notable names, were not then names to conjure with as they afterward became. And yet so rapid has been this development that those same men who were the beginners are yet in their prime of active life.

"Our Carty came with the telephone while it was yet being taught to speak, and has been either a co-laborer or leader in the development of that perfect comprehensive world-wide electrical conversational intercommunication which is rapidly bringing the whole world and all its people within speaking distance.

"While in the establishing of the methods for bringing all people together for electrical speech our Carty has been the most useful and constructive, and is now considered by all the foremost genius in this work, his work has by no means been confined to that branch, for in all other and collateral electrical development, whether affecting his particular work or not, he has been recognized as having a grasp of conditions to be overcome and a vision of what may be accomplished, which few possess.

"This tribute, from this club, is unique in that it is not a scientific tribute from fellow scientists; it is not a commercial tribute from corporation or association, but it is a layman's tribute, to one who is recognized and acknowledged as having made their business and social intercourse more easy, more comfortable and more agreeable and contributed so important an element into their daily life.

"And as one member of the associates who claim Carty as ours, I want to thank you, Mr. President and members of the Lotos Club, for all."

Chicago Vehicle Men Discuss Ways to Boost Sales.

An informal discussion of feasible co-operative measures for increasing the electric business in Chicago occupied the attention of the Chicago Section, Electric Vehicle Association of America, at its regular weekly meeting on November 30. A. J. Brechtel, a commercial truck salesman, led in the discussion, pointing out how garage men, who come in intimate contact with electric passenger-car users, can spread the gospel of the electric truck and aid materially in uncovering prospects. The business man who operates an electric passenger car is acquainted with the merits of the battery vehicle and should be a likely prospect for an electric truck.

J. W. McDowell thought that the Chicago Section could do the greatest good, first, by influencing vehicle manufacturers to maintain greater representation, numerically, and secondly, by inaugurating a co-operative billboard advertising campaign in the interest of the electric truck. He thought the greatest need is to educate the business man to the strength and stability of the electric vehicle industry and to the inherent merits of the vehicle itself. Greater representation in the field is necessary, he thought, to combat the influence of the army of gasoline-truck salesmen who compete for the business.

Harry Salvat voiced the garage man's sentiments by the statement that the manufacturers could gain their active co-operation and support only by making it financially worth while for them to act as electric truck missionaries. He believes the garage man should be the logical electric-vehicle merchant and be permitted to sell vehicles and accessories. Manufacturers should co-operate and not compete in this activity.

Gail Reed presented a motion which was unanimously carried, to the effect that every member of the Section submit at least one definite plan for greater co-operation in Chicago between the various elements of the industry.

G. B. Foster, chairman of the Section, called attention to the desire of the central station to co-operate.

ELECTRIC SERVICE FOR A CITY HIGH SCHOOL.

By C. L. Vestal.

Nothing better shows the peculiar fitness of electricity for general service than its use in the modern public high school. Aside from its general use for lighting, it offers a flexibility for power uses which makes it indispensable. Also in the modern large city high school the quantity used is an attractive one from the central-station point of view.

In the first place, it is almost entirely a day load. The lighting load comes on the peak in the building where night school is held, but the bulk of the school load is off the peak. This article will describe briefly the general service, and some of the special electrical equipment, of one of the large Chicago high schools, the Carl Schurz, located on the northwest side of the city, at Milwaukee and Addison Avenues.

The service is furnished by the Commonwealth Edison Company, one of whose large stations is on the northwest side, about two miles directly east of the school. At the rear of the building, near the northwest corner, is the group of transformers, as shown in Fig. 2. The three upper ones are of 30 kilowatts capacity each, in a bank, and step the distribution pressure of 2,300 volts down to 220 volts for the motors in the shops, and elsewhere. The single lower one is of 50 kilowatts capacity, and carries the lighting load. The secondaries are led through conduits to the main switchboard just below them on the other side of the wall.

The Power Circuits.

Referring to the picture of the main switchboard, Fig. 3, the large switch at the right side of the board is the main power switch. Just above it is a 220-volt, 200-ampere, multiphase watt-hour meter, made by the Fort Wayne Electric Works. The 220-volt energy is then distributed through the upper rows of three-pole switches shown at the left of the board.

There are in the building 26 permanently installed motors, ranging in size from 0.5 to 35 horsepower. The former drive emery wheels, the latter, two in number, drive the fans which force the fresh air over the steam heating coils and into the various rooms. These motors are all three-phase, 220-volt induction machines, for 60 cycles. Above one horsepower in size they are, with one exception, connected to General Electric drum-type controllers. In addition to the uses already mentioned, they drive lathes, forge blowers, trip hammers, saws, surfacing machines and suction fans.

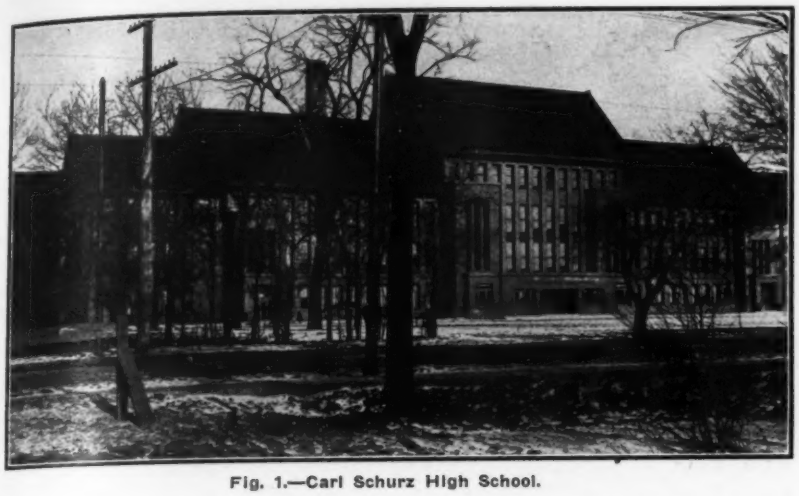


Fig. 1.—Carl Schurz High School.

A seven-horsepower motor in the engine room is direct-connected to a centrifugal pump which, in warm weather, when the steam heating plant is not in operation and the steam pumps are therefore not run, steps up the city water pressure to a serviceable figure for the building—about 45 pounds per square inch at the reservoir in the engine room.

A five-horsepower motor is direct-connected to a three-kilowatt Wood generator for furnishing direct current at 125 volts and at 4 to 8 volts to the Physics and Chemistry Laboratories. This motor-generator set is in a room near the Physics Laboratory, and is furnished with a complete switchboard of its own, with voltmeter and field rheostat, as well as distributing switches. This generator also supplies three-phase alternating current at 75 to 80 volts. A Scott connection changes some of this to two-phase four-wire if desired.

The total conected load in motors is about 130 kilowatts at the normal rating. In each of the shops—woodshop, forge, foundry, machine shop—all tools are motor-driven, both the individual and group systems being used. Each of these shops of course contains the regulation control and fuse board.

The Lighting Circuits.

Just to the left of the main power switch will be seen the main lighting switch. In circuit with this switch are two 115-volt, 300-ampere Fort Wayne watt-hour meters, and just above each of these is a Weston alternating-current voltmeter across the lighting line. The two lower rows of three-pole switches control the distribution of the lighting current to the various control boards about the building.

All corridor lights are controlled from a small board in the wall midway of the first-floor corridor. There are four corridors, one on each floor, and the total number of 16-candlepower equivalents in use in them is about 80. Because these corridors can get very little natural light, these lamps are in use about 8 hours a day, not counting the time the building is used for night school, when practically every lamp in the school is in use from 7:15 to 9:30 p. m.

The various room lights are controlled from cutout boxes near each end of each of all four corridors. A typical one of these boxes is shown in Fig. 4. In addition there is a special control box for the Assembly Hall, and one for the lunch room. It goes without saying that these boxes are fireproof.

Each standard classroom, which contains about 48 individual desks, is equipped with six-chain fixtures, with bell-shaped milk-glass shades, each fixture carrying a 100-watt tungsten lamp with frosted bowl. The five laboratories are each furnished with 16 to 18 similar fixtures. The shops are equipped with from six to ten 250-watt Nernst lamps. The ceilings and walls of most of the rooms being cream and tan calsomine, this general lighting is very pleasing. It has been found, however, that some of the night-school work requires a little stronger lighting, and this has been secured by adding a three-foot extension to each fixture in the rooms having certain kinds of work, with a light metal reflector over each lamp. When night school is over for the year—it lasts 20 weeks—these extensions are taken down.

Among the examples of heavy wiring in the building is that for the lanterns. No provision has been made to furnish direct current for these, and they are therefore put on the commercial lighting circuit. Each lantern outlet is conduit-wired directly from the cutout box for that end of that floor. The wiring is in each case sufficient to carry 50 ampers continuously. There are eight such outlets in the building, and a special form of receptacle was devised for them. (See Fig. 5.) The plug for this receptacle is simply a handle of hard wood, bored

Fig. 2.—Transformers for High School.

Fig. 3.—Main Switchboard for Building.

through lengthwise to receive the cord. (See Fig. 6.) The terminal end is wedge-shaped, and on each face of the wedge is a heavy copper plate, to which is attached one terminal of the cord which connects with the arc rheostat. This wedge fits tightly in the receptacle, and its copper plates make close contact with similar plates in the outlet. When not in use, the receptacle is closed by means of a polished metal door.

Since the study of electricity is one branch of physics, considerable and special provision is made for its accessibility and flexibility in the laboratory for that subject. The room contains, besides 32 seats for recitation, 8 students' experiment tables, each 7 by 3 feet. At each corner of each table there is a small box, 4 by 6 inches on the face, which contains two outlets, which may be used for any current desired. The first cover is a mere wooden door, opening downward on hinges. Behind this is a second door of slate, one-half inch thick, which is pierced with two holes, three-eighths inch in diameter, meeting the holes in the hard copper terminals behind it, Fig. 7. No. 8 wire comes to the two lugs in the lower part of the box, and fits into holes in these, being held by screws, which in these circumstances was considered superior to soldering. Connection is made to the hollow lugs on the upper side of the fuse gap by special connectors, similar in principle to the lantern plug already described, except that the contact is not divided. These are shown in Fig. 8.

The Wood generator already described delivers current to a distributing switchboard for this laboratory, situated directly behind one end of the lecture table. This switchboard is of white marble, 2.5 by 3.5 feet, and carries 10 double-pole double-throw knife switches for distributing energy to the tables. Each switch is numbered to correspond to the table it controls. The upper points give alternating current of 60 cycles, at either the commercial voltage of 115, or the 75 volts from the generator. There are two main switches, one for direct current and one for alternating current. The lower points of the small switches give direct current.

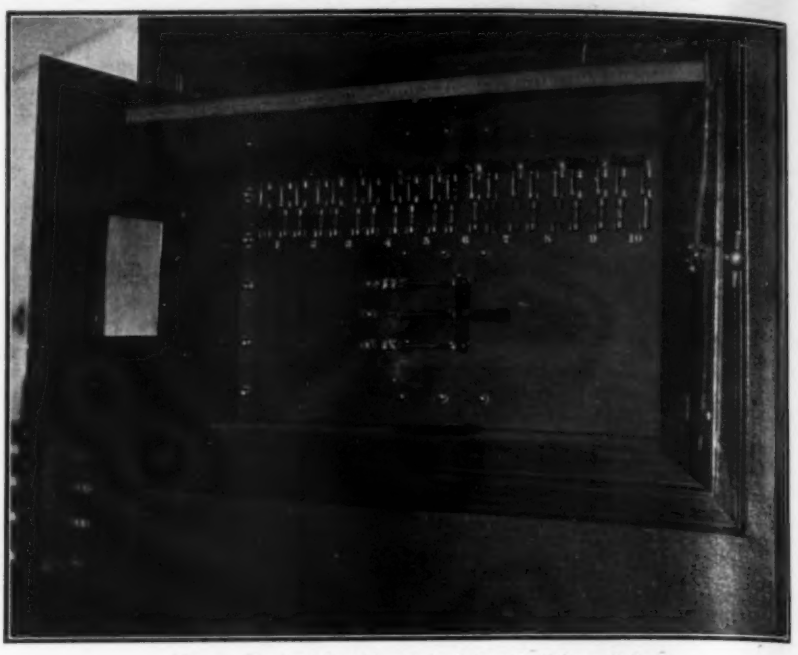


Fig. 4.—Typical Corridor Cutout Box in Schurz School.

Fig. 6.—Special Plug for Lantern Outlet.

At the end of the lecture table is a small switchboard, from which all these voltages, both alternating and direct, are available, beside two and three-phase alternating current from the generator before described. At the middle of the back of the table is a similar set of outlets.

The total connected lighting load of the building is about 77 kilowatts. This gives a total connected load of about 205 kilowatts. The load-factor will average 35 to 40 per cent during the five hours a day of active operation, or about 10 per cent for the entire 24 hours.

Water Power in Spain.

When the new water system for Madrid, Spain, is completed, it is estimated that the supply will exceed 206,000 gallons per minute and that, in addition, there will be a constant hydroelectric production of 21,000 horsepower.

Fig. 5.—Special Lantern Outlet, Carl Schurz High School.

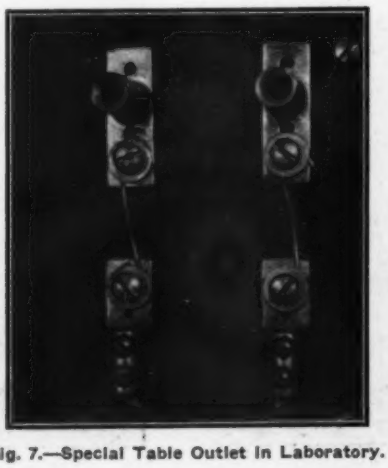


Fig. 7.—Special Table Outlet in Laboratory.

Fig. 8.—Special Table Connectors in Laboratory.

BOOK REVIEWS.

"Plane Geometry." By C. I. Palmer and Daniel P. Taylor. Chicago: Scott, Foresman & Company. Cloth, 277 pages (5x7½ inches), illustrated. Supplied by the Electrical Review Publishing Company, Inc. for $1.00.

This book presents the essentials of geometry with some of their applications. It is written for high school pupils and departs decidedly from the methods of presentation of Euclid, while not going as far in this direction as some of the other modern texts. Logic has been intentionally sacrificed to insight whenever it was believed by the authors that the general geometric interest of the student would thereby be materially subserved. This idea has been continually kept in mind in presentation. The actual geometrical study is begun after a preliminary statement showing its uses, without a formidable array of definitions, axioms and principles. A large number of original exercises are included to test the student's comprehension of the subject. These exercises range from quite elementary ones to others of considerable difficulty. While intended for class-room use under the direction of an instructor, the book seems suited to individual study. It is well presented and the diagrams are clear and well drawn.

"Electric Wiring Specifications." By J. H. Montgomery. New York: D. Van Nostrand Company. Cloth, 139 pages (4x6¼ inches). Supplied by the Electrical Review Publishing Company, Inc. for $1.00.

This book is intended primarily for the convenience of architects, general contractors and others who may find it necessary to draw up specifications for electrical work. It is intended to provide good modern construction for work of comparatively small extent. Forms of specifications are given, with samples of actual schedules and a table of illumination values suited to different applications. Alternate pages are left blank for the insertion of notes.

"Examples in Alternating Currents." Vol. 1. By F. E. Austin. Hanover, N. H.: Published by the author. Flexible leatheroid, 223 pages (4¾x7½ inches), illustrated. Supplied by the Electrical Review Publishing Company, Inc. for $2.40.

This volume considers the subject of alternating currents mathematically, and a considerable portion of the book is taken up with problems leading up to the work in alternating currents. This is done with the object of making the reader conversant with the properties of quantities undergoing simple harmonic variations. This necessarily involves considerable geometry, trigonometry and algebra, as well as some calculus. Some of the formulas given are not fully explained and the reader may be somewhat jolted by having quantities stated in seven significant figures in a formula which is only an approximation. The latter part of the volume contains many problems in inductance and capacity under various conditions, with applications to transmission lines. There are altogether 57 problems and a table giving values which are convenient for purposes of computation.

Electrical Prosperity Dinner in New York.

Under Jovian League auspices, New York's leading electrical men to the number of 300 met on December 1 in Hotel Martinique at an enthusiastic Electrical Prosperity Week luncheon. Letters were read by Chairman James M. Wakeman, general manager of the Society for Electrical Development, from President Wilson and Thomas A. Edison, commending the widespread participation the week enjoys and expressing congratulations on the success of the country-wide campaign which has done so much to restore the nation's prosperity to a firm basis.

Delos F. Wilcox, deputy commissioner of the New York Department of Electricity, spoke of the necessities of electricity in the progress of municipalities and paid a high tribute to the local Electrical Prosperity Week committees in achieving an event of national importance. Mayor Mitchel, who is ill with appendicitis, sent, by his secretary, Theodore Rousseau, a message of congratulations to the Jovians and to the electrical industry. John Tyrone Kelly, of the Society's staff, spoke of the more serious thoughts the week inspires.

President Wilson's letter follows:

"I am glad to learn from your favor of the eleventh instant that the Society for Electrical Development will celebrate Electrical Prosperity Week from November 29 to December 4 and to be advised that the object of this celebration is to create in the public mind a firm confidence in the business institutions of America. There can be few things of greater importance to the people of the United States than that they should have strong confidence in themselves and in the institutions and the industries which they have created. I earnestly commend the effort on your part to develop and maintain reliance by our people in their own ability to meet the problems of industrial and national life. Such reliance may be wisely based on what we have achieved heretofore. With such a reliance we may look fearlessly to the future."

Mr. Wakeman stated that the example of the electrical industry in aiming its attack against depression and in promoting a nation-wide campaign intended to show how electricity and prosperity go hand in hand will live long after this week is closed. He said other industries may well study this enterprise and determination of the electrical industry to establish in the public mind a firm faith in the future of America's business.

From every section of the country reports by telegram and letter reaching the Society for Electrical Development record celebrations which far surpass in point of enthusiasm and interest all expectations.

Electrical Supply Jobbers Debate and Play Golf.

Discussion of the co-operative movement of the Pacific Coast jobbers and electric lighting companies, recommendations relating to marking standard packages by the manufacturers for more convenient handling, the decision to become affiliated with the American Fair Trade League, Electrical Prosperity Week, price maintenance and the annual golf tournament of the jobbers and manufacturers were the features of the Hot Springs, Va., meeting of the Electrical Supply Jobbers' Association, November 17-19.

James M. Wakeman, general manager of the Society for Electrical Development, aroused the members to a high pitch of enthusiasm with a spirited address relating to the campaign now being conducted by this organization.

E. W. Rockafellow and Thomas M. Debevoise discussed at length and in plain language the necessity for a more sincere manifestation of the spirit of co-operation by jobbers and the other elements of the industry.

Ernest H. Gaunt, of Boston's Statistical Organization, addressed the meeting, showing by means of a graphic analysis the recurrence of definite cycles of business activity and depression.

Hereafter central-station managers will be invited to attend the jobbers' meetings, and in connection with the next meeting, which will be held in February at Detroit, Mich., special effort will be made to have a large attendance of central-station men from territory contiguous to that city.

Bangkok's Power Houses.

In the November 23 issue of *Commerce Reports*, the daily official publication of the Bureau of Foreign and Domestic Commerce, Washington, D. C., is given an account of the two electric power plants at Bangkok, Siam. This should prove of interest to electrical exporters desirous of building up trade with the Far East.

NOTES ON TELEPHONE PLANT ORGANIZATION.

By F. Day.

Before the general inauguration of the principles of scientic management, as applied to telephone plant organizations, can be effected, certain conditions must be accomplished which will make any extensive results possible. The entire organization of each plant concerned must be educated to the desirability of this form of management. Their personal welfare must be looked into in such a manner as will instill confidence and trust in all employees. It should also be remembered that the object of scientific management should be for the mutual benefit of the employees and of the company, and in any case where the benefits and savings effected are not mutually enjoyed this form of administration must be considered a failure. Therefore, too much stress and emphasis cannot be placed upon a proper setting for the inauguration of this plan.

There are but four basic principles of scientific management, and they are defined as follows:

(1) The development of a true science of work.

(2) The scientific selection of workmen.

(3) The workman's scientific education and development.

(4) Intimate friendly co-operation between the management and the men. (Taylor.)

Although these principles are named in their logical order it has been found far more practical to develop them, together and not in the sequence given. None of these principles are independent, and in order for any success to be made in their adoption they must be judiciously co-ordinated, developing each, step by step.

Probably the first step to be taken in the development of a true science is to familiarize the men of the organization with the standard practices, specifications and other rulings that have been made relative to their work. In this connection their scientific education and development can be gradually accomplished. It has been found that an excellent means of accomplishing these developments are "Plant Meetings," "Corporation Schools" or "Corespondence Schools." The plant meeting, as it is familiarly termed in our organization, where these plans have been adopted, is an informal weekly meeting of all the employees interested, for their education and development by mutual experience and by instructions from well informed superiors. The work taken up in these meetings was the telephone subscriber's set, its circuit, operation and faults. Next the handbook of substation wiring, each page discussed at length. Following this the handbook of exchange construction, with similar discussions.

It was found that the second principle automatically worked itself into plant meetings, the desirable and progressive employees attending without fail, while the less desirable failed to attend. The attendance at the meetings was not compulsory, thus giving each man his own choice in the matter. It is an almost infallible rule that those who do not, through their own choice, attend these meetings, or have other means of acquiring knowledge, are unsatisfactory, if not undesirable employees.

Theoretically, the development of a true science, as set forth by the authorities on this subject, is accomplished as follows: Select 12 or 15 different workmen from as many different exchanges, and if possible from different parts of the territory, who are especially skillful in doing each particular kind of plant work. Study the exact series of elementary operations or motions, the means and methods which each of these men uses in his work, as well as his tools and other equipment. After each man's program of work has been developed, study each operation or motion with a stop watch, and ascertain the time required to make each of these motions or operations. It will be found that each of these especially skillful men differ widely in the time required for the various elementary operations of his work.

With the information now on hand, a composite program can be made of the work under study with the quickest necessary motions, movements and operations. Likewise the best tools and implements required for the work can be selected from the outfits of the 12 or 15 men.

The object of such time studies, as outlined above, is to determine the actual time necessary for any specific operation. It has not been found at all satisfactory or practical to use time studies for this purpose in telephone work. The cause is the great variety and classes of work which any member of the organization may be called upon to do. However, it has been found very profitable to make time studies for the purpose of showing the men where they actually lose time, how to organize their crews, and how to make themselves better and more valuable employees. The selection of tools is practical, although it meets with opposition to some extent on the part of individual employees. After a trial, however, most men are pleased with a scientifically selected tool. In order to see the exact progress made in this work it is well to make a general survey of the organization, cost of line-order execution and trouble clearance, as well as the quality of work done. With little effort these data may be kept chronologically, and in the form of curves makes a surprising graphic sketch of the possibilities of this plan. Following is given a sample of the organized and classified data for trouble clearance:

This report covers one week, ending January 9, 1914. To both the trouble man and the wire chief it shows his exact standing and desirability as a trouble man. The personal equation is eliminated, thus presenting the facts of the case. It will be seen that 94/223rds of the visits made were general inspections. These consist, primarily, of low-insulation lines discovered by the ballistic test. Also that only 8/223rds of the total tickets handled were reported "No trouble found" by the trouble man, and that but 9/223rds were repeated troubles within the past 30 days.

This report was made three months after the initiation of this plan.

Name.	Trouble Tickets.	General Inspections.	Total.	N. T.	Troubles Cleared.	Repeated Troubles.	Troubles Cleared Per cent of Own.	Troubles Cleared Per cent of Total.	Repeated Per cent of Own.	Repeated Per cent of Total.
Kinley.....	27	54	81	3	78	2	96.3	36.3	2.5	22
Swanson....	50	29	79	2	77	4	97.5	35.8	5.5	45
Van Houten.	52	11	63	3	60	3	95.2	27.9	4.8	33
Total.....	129	94	223	8	215	9	96.5	100.	4.1	100

Rating.	First.	Second.	Third.
Quality.	Swanson.	Kinley.	VanHouten.
Quantity.	Kinley.	Swanson.	VanHouten.
Repeated.	Kinley.	VanHouten.	Swanson.

Foreman	Orders Handled Class A	B	C	M	W	Total	Cost Per Order Class A	B	C	M	W	Total	Cost per Crew
F. I. G.....	3	4	2	6	4	19	$4.59	$0.88	$1.39	$2.89	$2.50	$2.60	$49.44
J. M. V.....	7	4	2	5	8	26	2.96	1.10	1.45	2.40	1.23	1.87	48.81
W. G. J.....	1	3	2	2	1	9	0.26	0.37	0.49	1.12	1.29	0.65	6.10
Total.....	11	11	6	13	13	54	3.16	0.82	1.11	2.43	1.63	1.56	104.35

	F. I. G.	J. M. V.	W. G. J.	Total
Unfavorable inspection reports	1	3	0	4
Subscriber's complaints	0	0	0	0
Orders not worked on schedule	2	1	0	3
Orders handled, costing over $5.00	2	0	0	2

Similarly classified data of Line Order execution and costs are shown in the above table.

This form shows the quality and quantity of work performed by each crew.

Although these two tables are very valuable in determining the progress made by the inauguration of this form of management, they are far more so when used as competitive reports to the workmen. The institution of competitive reports instills in the workman the spirit of the game, and creates in him a new interest in his work; interest with which he has never before been acquainted. Some of the most obstinate cases of indifference have been cured by these means. Particularly, one man, who had been employed on trouble work, staying at the bottom of the "quality and quantity list" for three weeks, and seeming unable to make any progress, came to the wire chief, and frankly admitted that he was not suited for trouble work, and asked to be changed to another job. At that time this man was doing what, under ordinary management, is generally conceded to be a good day's work. (This is another case where the second principle works automatically.)

These "reports" should be given to all trouble men and line-order foremen at the end of the week for which they are made.

The cost of keeping this information is insignificant, when compared with the results obtained. All the necessary information for the records and reports appears on the face of the trouble ticket, or line order. The trouble report can be made for five cents per thousand stations per day, plus twenty to fifty cents per week. The line-order information cost is approximately 1.5 cents per order handled.

Co-operation.

Although much is being said of co-operation, it seems that the fact that it pays, and pays well, has not been taught to many men, of all stations in life. Those who have seen the light have given it the newer name of "Enlightened Self-Interest"—which is truly the case of co-operation.

Although the intimate friendly co-operation between the management and the men is cited as the fourth principle, it must, with the other three, be treated and administered co-ordinately. The co-operation on the part of the management, which will in all cases consider the man's boss or immediate superior, does not commence at 7 a. m. and stop at 5 p. m. Instead it should be strongest during the employee's absence from duty, for during the day the boss has one eye upon him at all times—even if the employee does not know it.

Co-operation to be of real value must go with the employee to his home, to his difficulties, to his joys and his misfortunes. Perhaps this will seem strange to you—but it is nevertheless true. Do you not expect some study on the employee's part during his hours of recreation and rest? Most certainly. Then why not consider both sides of the proposition?

Next to his home folks, be each employee's confidant. Know him—even well enough for him to call you by your given name. Again you are surprised. Why not? Are you not both working for the same company? Are you not even partners in that work? Let him address you "Mr." through well founded respect, and not by fear of losing his job.

Let not your interest in or co-operation with the employees with whom you work stop at the present. Know their ambitions. These are the most valuable asset a man has. They are the seeds which when properly developed, grow to bear fruit of which any man should be proud.

If a man fails at his job don't fire—he is only half to blame at the worst—remember that he represents an investmen of from one hundred to one thousand dollars, that he may be ill fitted for the work you have placed before him—and that perhaps you have failed to teach him how to properly do the work. Look into his case and see for what kind of a job he is fitted; put him in that job. If you have no such job transfer him to some one who has.

Do not hold a man down. This is one of the largest factors of many men's failures. Give a man all he can do and let him have the joy of hard work. If you can recommend him to a better job, do it. Let him go. He will learn something of value to himself and in nine cases out of ten if you ever want him again he will return, better fitted to relieve you of responsibilities and cares—taught by experience to appreciate a good boss who can co-operate.

And if one of the men of whom you are boss wants your job—and can hold it—arrange by all means to give it to him, for no better indication of a man's ability could be made than for him to develop his own successor.

Plant Schools.

The various factors that enter into a well managed plant school will now be considered in the order of their importance. No man, however well chosen, will make much of a success without some teaching. The successful men in most organizations today were taught, but usually self-taught. These men are successful for no other reason than, having developed energy enough to learn new things, they found the execution of the principles comparatively easy.

To teach men, regardless of their present standing, position or occupation, will develop them to some extent at least, and in many instances to a surprising extent.

The object of the plant school is to help men learn things pertaining to their work. As before stated, the attendance is not compulsory, but advised. No plant school is complete without a competent teacher, a suitable teacher, a suitable room, a blackboard, chalk and eraser, and sufficient chairs to accommodate the attendants.

The teacher should be competent to explain elementary problems in physics, electricity and magnetism, should have a working knowledge of the specification handbooks, and, most important of all, should believe in himself, his job and his fellow workmen.

The room may be a stock room, but preferably an office, where there will be less to detract the attention from the school work. The blackboard should be at least four feet square, and larger if possible. "Beaver board" painted dull black, is very suitable for this purpose. The problem of sufficient chairs is very easily solved by using chairs from the retiring room, which should not interfere with the retiring room during the evening.

It has been found well to have plant school but one night per week, although oftener is desirable. The time taken each Monday night was from 7 to 9:30 o'clock.

The meeting should be opened promptly at the appointed time, with a roll call, and any employee arriving late should be so recorded in the roll book. Each employee is furnished with a memorandum book for any kind of use he desires in connection with his work, such as suggestions, memoranda to be taken up at plant meetings, information for work orders, etc.

Next after the roll call, a second call is made of those present for any questions, suggestions or recommendations. These are taken up and discussed under the careful supervision of the teacher. Next the lesson for the evening is explained, discussed and all questions satisfactorily answered.

Among the lesson subjects to be discussed are:

(1) Classification of accounts with detailed graphic explanation of the accounting system, paying especial attention to the "why" of all accounts.

In this lesson it is a good plan to consider the accounting system as a whole, explaining the reserve accounts for depreciation, maintenance and rearrangements; how they are accumulated and how disbursed.

Consider a new pole placed in plant charged to the Construction Account. This is the expenditure of new money—authorized by the Board of Directors. This department of organization has now performed its function till the pole is taken out of plant. The executive officers have been notified of the increase in plant, and out of the revenue they proceed to lay aside each year

eight per cent of the cost of this pole placed in plant, as reserve for depreciation or replacement. In addition to this, five percent is laid aside for maintenance or keeping the pole in ordinary repairs. Further, one per cent is laid aside for rearrangements and changes.

At the end of four years the pole has been washed out, having been set very close to a ditch. We dig a new hole and set the pole again and charge the cost to the repair account. The auditor then knows that this expenditure has not increased or decreased the value of plant, and that the cost should be paid out of his reserve for maintenance and ordinary repairs. At the end of six years we must move the pole to a new curb line—a distance of, say, two feet. This we do and charge the cost to the rearangement or "move" account, which tells the auditor to pay this expense out of his fund for moving and rearranging poles.

At the end of twelve years our pole has lived its life, rotted off at the ground line and ready to fall. Above the ground the pole is sound, and conditions will permit of resetting—this we do. Since the pole was originally 35 feet high and we have reset it, after it has lived its natural life of twelve years, it must now be 30 feet high. We cannot truly say that resetting the pole in this case was an act of maintaining it. Rather we prolong the life of part of the pole, and the cost of such work should be charged to the depreciation or replacement account, which the auditor has been laying aside each year, and which by now (12 years at 8½ per cent) represents the original cost of the pole, plus the cost to dismantle it.

Therefore, in prolonging the life of the pole, we would allow the depreciation or replacement account to continue to increase beyond the actual value of the pole—but for the fact that the cost of prolonging its life were charged to the depreciation account.

Eventually conditions require that we take this pole out of plant—absolutely—and place the wires which it carries underground. The cost of removing the pole is charged to the depreciation account, as was the cost of prolonging its life, and the auditor immediately returns the original cost of the pole, from the reserve for depreciation and replacement account to the general cash capital of the company, subject to the will of the Board of Directors.

This method of explanation of all of the accounts will give accuracy and intelligence to the classification of time and material.

(2) Next the subscriber's set, its circuit and faults, with an explanation of the construction, operation and relation of each part to others is taken up. Circuit diagrams on the blackboard should be made by all present. In making these sketches, colored chalk should be used to more clearly show the direct current, the alternating current and the ringing-current circuits.

In order to clearly show the function and operation of each component part of the subscriber's set, it will be necessary to make several elementary experiments in electricity and magnetism.

Practical Applications.

The keynote of economic production of work is the planning of work and the working of that plan.

In order to plan work intelligently a perfect knowledge of the work to be done, of the time required and of the men that are to do the work is necessary.

There are in general four classes of work carried on in a telephone exchange, viz.:

Executive and supervision, routine outside, routine central office and job or estimate work.

In the adoption of this or similar plans, it is best to begin in the executive office.

The office arrangement should be such as to take best advantage of the natural light and ventilation. These should be supplemented by good lighting and, when necessary, electric fans.

The office furniture should consist of sufficient desks, files, clothes lockers, stationery cabinet, table and chairs, but no superfluous fixtures, as such have no direct usefulness and are usually used for storing useless articles.

In addition to the necessary fixtures and furniture, various office appliances are necessary. They are a good drawing board with a set of instruments, a typewriter, a slide rule, a duplicator and office manual.

The desks should be preferably of the sanitary flat-top type.

The file requirements vary in nearly every office; however, the only high-grade file necessary is that used for current correspondence and drawings. The permanent file should be of the "Stow-away" type.

Metal clothes lockers of sufficient capacity for the employee's requirements, and no more, should be provided.

The stationery cabinet manufactured by the Terrell Equipment Company, of Grand Rapids, has been found very satisfactory as it permits of the vertical storing of standard-sized forms. In this method tabs with a protruding edge are inserted between the supply of each form. This edge is folded over to present a flat surface to the front of the cabinet. Upon this surface may be marked the form number and use.

Forms for supplies and material, disbursements, accounting, instruments, accidents, etc., are then placed in groups so that a form, pad or package of stationery may be readily located and removed without the loss of time and the disarrangement of the cabinet.

The office appliances are of standard make and are, except the slide rule, duplicator and office manual, commonly known and used.

The duplicator can be used in furnishing instructions of a permanent nature. From 50 to 100 copies of written, typewritten or drawn matter may be made from one impression. This in most cases replaces the blue print with its difficult process and special requirements. Full instructions for use are furnished with the standard makes of duplicators.

The office schedule is the organized instructions for handling all routine office work. Since the schedules for various offices differ widely, no hard and fast general plan can be advocated.

The primary object of a schedule of any kind is to set a standard time for any given series of operations, thereby eliminating lost time, lost motion and lost effort.

It is placing into practice the principle of having a place for everything and everything in its place, with the time element considered.

That the work of the average employee can be done in half the time ordinarily taken may be contested by many, but cases have been found where a "day's work" has been done in two hours without exhaustion or even fatigue by the adoption of a schedule.

That routine exchange work can be effectively and efficiently scheduled has been satisfactorily proven by the reduction of forces 30 per cent within 30 days after its adoption. The whole plan of scheduling this part of plant work revolves around the idea of "getting organized."

The specialization of station wiremen, linemen and foremen solves the problem to a certain degree, in that at the beginning of each individual job or order the work is planned in the foreman's mind and each man knows what to do, how and where to do it.

The same idea is worked out by the chief installer by having each crew assigned to a certain territory for each day in the week. That this plan may be flexible and easily worked out under the strain of extraordinary conditions, written instructions must be prepared for reference at such times. These instructions must not conflict with the present general instructions in circular letter, handbook or bulletin form, but should, instead, modify them.

If such general instructions are in error, the proper authorities should be consulted with an aim to correct them.

As applied to the general instructions of one operating company, the follow-

ing routine has been adopted with gratifying results.

Plant Routine of Line and Work Orders.

Line Orders.—Copies No. 1 to 4 of all exchange line orders will be received from the commercial organization by the chief installer. These orders will be transmitted by an invoice showing the class and serial number of each order.

The chief installer will mark all copies of each order with the date received, and check with the invoice, which is then receipted.

The No. 4 copy of the orders are detached, filed numerically in a style "Y" sheet holder, and the remainder forwarded to the wire chief, who enters assignments on all copies, forwards No. 3 to the chief operator and returns No. 2 to the chief installer.

The No. 2 copies are then filed under territory, day and foreman, in, on and by which they will be executed. These territories may be readily determined by analyzing the location of two or three hundred line orders' addresses.

Each foreman's district or week's territories should include but five days' work, allowing Saturday for completing any work not finished during the week, due to handling extraordinary cases or conditions which could not be foreseen and scheduled. This proves flexibility from an "expansion of work" viewpoint.

When the line orders have been assigned to the proper districts, notation of the schedule date of completion shall be entered on the receipted invoice, which is then returned to the commercial organization as a guide to future requests from subscribers and others as to when the order will be executed.

In order to handle change of location under the single-order plan, a rubber stamp reading "Move Order—Station Removed at Old Address by..... .....Date....." effects a two-order system, the foreman completing the "In" portion of the order O. K.ing the line order proper, while the one working the out portion O. K.'s the rubber stamp blank.

Work Orders.—Work orders are of two classes, immediate and routine. Either of these two classes may be originated by any person, whether an employee of the company or not, but are especially expected from employees of the Plant Department. The nature and number of work orders originated by plant employees indicates their quality of observation and judgment.

All work orders are made in duplicate by the testboard man at the request of the originator, and bear the names of the originator and maker. Immediate orders are handled by the crew nearest the order. Routine orders are handled as follows.

The duplicate copy No. 1 is filed at the testboard pending execution, and the original copy No. 2 is forwarded to the chief installer, who, as in the case of line orders, locates the order, and assigns to the proper foreman for execution on a predetermined date. It is not anticipated to execute all routine work orders to schedule, but as spare time appears in each day's work. This provides further flexibility to this plan.

Execution of Orders.—We now have the line and work orders ready for assignment, each day's work in a certain territory by a certain foreman on a predetermined date.

There is considerable economic advantage at this point, since each man of each crew knows his duties on each job, and each foreman knows where his work will be on any given day, knows the availability or congestion of facilities in that location, knows the peculiarities of street numbers and addresses and is familiar with every alley short cut, every terminal and in more cases than would be supposed of the cable distributions and even open duplex lines.

Every order in a day's territory is assigned to the foreman on the morning of that day. These he assigns in a route while enroute to that territory, giving line orders preference over work orders.

Upon arriving at a job the test board is called and any switchboard marking, number plate, lamp-cap or frame work is immediately commenced, so that when an O. K. is given to the foreman, it is final and includes the entire job, leaving the station ready for service.

The time and material for each job is entered on the line order at the time of completion.

At the end of the day, a summary time report is made for the crew and team for the day under the various account numbers. All line and work orders completed during the day are attached to this summary and returned to the chief installer.

The No. 4 copies of the orders completed are removed from the numerical file in the style "Y" sheet holder and the copy is now ready to file in numerical order in series of 100 for permanent record.

After being scrutinized by the chief installer for duplication of work, or other inefficiencies or errors, the day's orders are forwarded to the time-and-material clerk for final editing.

All calls for information as to the date of completion of orders, made to the plant organization, will be referred to the commercial line-order clerk. The commercial organization should be so advised and requested to refrain from referring calls for such information to plant employees.

Job and Estimate Routine.—Except the plant foreman, no regularly authorized employee shall work on a job or estimate without the specific permission of the district plant chief.

Under no circumstances shall work not covered by a job be charged to that job, or job authorization be used for any other purpose than that covered by the job specification.

Only unit labor costs that are accurate for the location of the work to be performed are to be used in preparing jobs and estimates.

Each job assigned to a foreman shall be completed before another job is assigned to him, unless specifically recommended by the chief installer and plant foreman and approved by the district plant chief.

Jobs and estimates may be prepared by the chief installer, plant foreman and district plant chief, and forwarded for approval. The copies of a job shall not be distributed till the stockkeeper has checked the list of material and segregated such items as are covered by the job. Should the necessary material not be in stock, requisition for the difference shall be placed, and the job held till all the necessary material has been received.

When all the material for a job has been placed in stock, the job specification and authorization sheets shall be distributed, the chief installer receiving two copies, he furnishing the job foreman with one copy. The foreman shall proceed with the work covered by the job with the most economic crew, as follows:

Class of work.	Foremen.	Linemen.	Groundmen.	Wiremen.	Team.
Pole line	1	-	3	-	1
Stringing wire and messenger	1	2	3	-	1
Stringing cable	1	2	2	-	1
I. B. distribution	1	1	1	2	0
Overhauling stations and cut-ins	1	1	-	1	1
Installation of stations	1	-	-	1	1
Underground cable	1	2	2	-	1

Routine Central-Office Maintenance.—That part of central-office maintenance of the routine or preventive class can be scheduled to a great advantage to the employee and employer. Such a schedule must be adjusted to the local conditions, but as in all other work, should not be adjusted to the employee doing the work.

Street-car employees of Edinburgh, Scotland, have recently received an increase of wages of two shillings per week. This represents more than $27,000 per year, as there are over 1,000 employees.

New Electrical and Mechanical Appliances

Attachment Plug with Soldered Connections.

The use of electrical appliances of many kinds that are connected by cord and attachment plug to wall or fixture outlets is rapidly increasing, particularly in the home. This increase is due largely to the great convenience and safety of such devices, which two important considerations appeal strongly to the feminine members of the household. It happens, however, that occasionally the connection in an attachment plug becomes loose or broken, which not only puts the appliance out of commission, but may instil trepidation on the part of the user.

To overcome this difficulty there has been placed on the market a new attachment plug which has no binding posts or screws of the usual pattern but in place thereof uses soldered connections. The

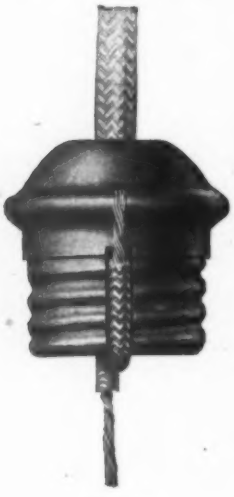


Fig. 1.

Fig. 2.

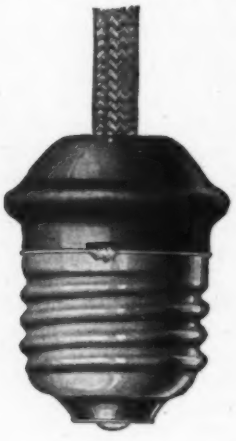


Fig. 3.

method of wiring is shown from the accompanying illustrations. The wire is inserted through the center hole in the solid body and one end bent over in the groove as shown in Fig. 1. The brass screw shell with attached center contact is then screwed into place and clinched to the plug body by a suitable tool, leaving the cord projecting as shown at *A*, Fig. 2. The wire ends are then soldered, completing the plug as illustrated in Fig. 3. It will be seen that this plug is very simple and has but two parts. The assembly and connection of the plug takes but a few moments, it is claimed. It eliminates the liability to loose connections or short-circuits.

This plug is known as the Attacho; it is manufactured by R. S. Mueller, 425 High Avenue, Cleveland, O.

New Electrical Equipment for Boston Elevated Railway.

The Boston Elevated Railway Company is about to make extensive additions to its power plant and substation equipment, at an estimated cost of over $1,000,000. The plan is to increase the size of the main alternating-current generating station at South Boston and to install a 35,000-kilowatt horizontal turbogenerator with surface condenser, the generator wound for 13,200 volts. A 200-kilowatt combination turbine and motor-driven exciter, and switchboard panels for the new apparatus and for the additional feeders, will be installed. Three new 4,000-kilowatt rotaries will probably be installed in substations.

The proposed new unit is considered more practicable than one of smaller capacity, though a generator of 20,000 kilowatts would probably meet the requirements for a few years. The engineers, however, recommend one of 35,000 kilowatts, though costing about $200,000 more, on the ground of greater economy of station operation. It is estimated that for five years, beginning 1917, based on 200-pounds boiler pressure, a total output of 1,180,000,000 kilowatt-hours can be produced, with 35,000-kilowatt unit installed, for $3,200,000, while with a 20,000-kilowatt unit the cost would be $3,400,000.

The three 4,000-kilowatt rotaries are planned to be so located as to reduce the radius of feed of the company's direct-current generating stations and to displace 2,000-kilowatt units which would be located in substations on the outskirts of the territory.

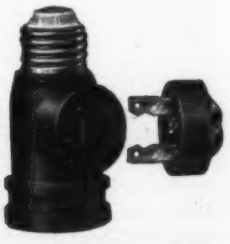
The total capacity of the Elevated Company's stations and substations is now about 83,000 kilowatts in direct current and 48,500 kilowatts in alternating current.

A bond issue to cover construction costs has been authorized.

Composition Side-Outlet Current Tap.

To accommodate the steadily increasing demand for electrical fittings that can withstand general hard usage much better than porcelain, the firm of Harvey Hubbell, Incorporated, Bridgeport, Conn., has placed on the market a composition side-outlet current tap. It is made of a tough, heatproof material with high insulating qualities. In railroad shops, shipbuilding yards and other industrial plants devices of this type are subject to considerable rough usage and it was for this class of electrical users that this fitting was primarily designed. It is serviceable, however, in many other places where a current tap of rugged nature is desirable.

The side outlet is of the T-slot type and therefore permits the interchangeable use of all the nonpolarized Hubbell caps. A deep groove is provided to permit the ready attachment of shade-holders.

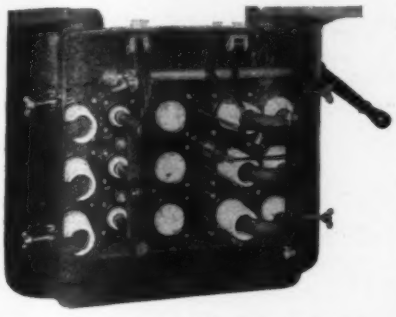


New Current Tap.

Automatic Pole-Line Oil Switch.

A new pole-line oil switch has been developed which automatically opens the circuit in which the switch is connected if the current in that circuit exceeds a certain definite amount for which the tripping mechanism is set. In many cases the use of this switch in connection with pole-type transformers obviates the necessity of bringing high-tension lines into a building.

The switch is closed by a handle affixed to the frame. The automatic operation on overload is effected by tripping coils in series with the line. These coils are located in the oil vessel under oil and are connected to a common tripping lever by separate wooden rods. The tripping device may be actuated by any one of the overload trip coils, or by a hand-operated trip rod, not visible, but outside the switch frame. The switch cannot be opened by the closing handle. An inverse-time oil dashpot (see illustration) connected to the tripping device affords a time delay in automatic tripping.



Top View of Switch with Cover Removed, Showing Time-Limit Dashpot.

Insulated cables enter the switch from below through porcelain bushings in an overhang on the switch frame. The space between cables and these bushings, as well as other bushings through which the cables partly run, is filled with insulating compound. There are no uninsulated parts within the switch frame.

The oil vessel has an insulating lining, wooden barriers between poles and between trip coils, drain cock and filling tap so that the oil may be changed without lowering the vessel; it also has handles to assist in handling the switch or in removing the vessel for inspection of the contacts, which are of the sliding-wedge type of construction.

The switch is thoroughly weatherproof with the exception of the operating lever and hand-tripping rod; all parts are enclosed and protected from the weather. The cover is grooved on the under side to fit closely over the edge of the frame. The oil vessel fits around a flange on the bottom of the frame.

This switch can be obtained single, double, triple or four pole, single throw, for use up to 15,000 volts and 300 amperes. It is built by the General Electric Company, Schenectady, N. Y.

Automatic Oil Switch with Three-Coil Time-Limit Trip.

Electric Garbage Wagon Effects Economy.

Economical costs of garbage hauling are obtained by the Sanitary Department, City of Boston, by the use of electric trucks. The city owns two five-ton General Motors Truck Company's dumping wagons, each equipped with a 44-cell, 29-plate Philadelphia battery. The vehicles are charged at night at the garage operated in connection with the Public Works Department.

Each vehicle has a capacity of 10 cubic yards of refuse, which consists mainly of ashes collected from private premises and removed to the public dump. An average of four loads a day are hauled, the aggregate mileage being about 25 per day. Six men are assigned to each wagon, the driver, his assistant, who handles the loading, and four street men who roll the barrels to the van and throw them aboard.

Electrically Driven Garbage-Collecting Wagon in Use in Boston.

Accelerator for Hardening Concrete.

Experiments have been made by the United States Bureau of Standards to develop a method for accelerating the hardening of concrete, in order that the material might be used in revetment work in place of the willow mats that have been used in the past along the Mississippi River. The Bureau finds that 4 per cent of calcium chloride added to the mixing water increases the strength of the concrete at the age of one day 100 per cent or more. In some cases the strength of the concrete in which the calcium chloride was used at the age of two days equaled 75 per cent or more of the strength normally attained in one month.

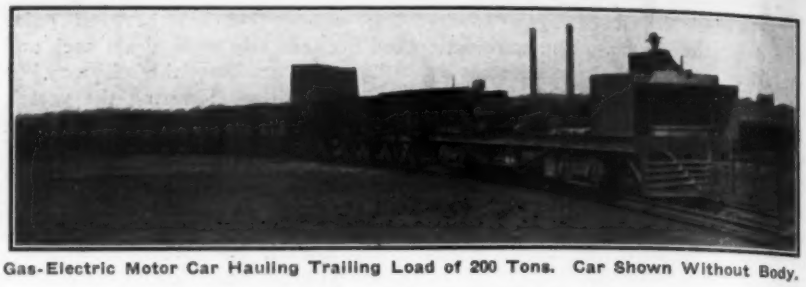
The Bureau of Standards believes that the findings of this investigation will be of appreciable value in concrete construction.

New Toy Transformer.

An improved type of toy transformer has been placed on the market by the Thordarson Electric Manufacturing Company, Chicago, Ill. To protect the transformer from overloads or short-circuits on the secondary side, it is provided with a self-contained automatic cutout. A push-button projecting from the case permits connecting the transformer to the circuit again, but only after the overload or short-circuit condition has been removed.

Electrical Transmission on a New Zealand Gas-Electric Motor Car.

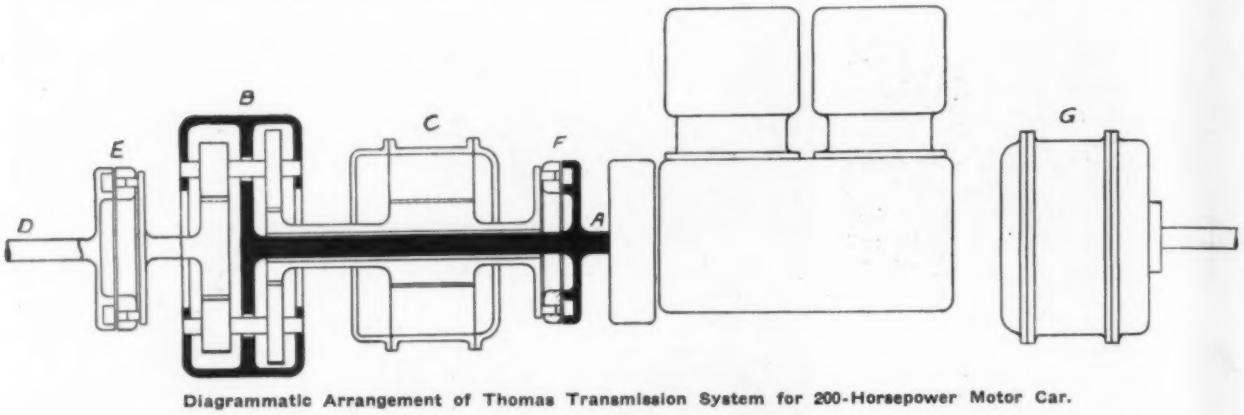
What has been termed by its English builders as a "petrol-electric locomotive coach" has been constructed and equipped in England on the Thomas transmission system for use on the New Zealand Government Railways. Herewith it is shown hauling a load of 200 tons, an interesting performance in view of the fact that the engine is only 200 horsepower, and the car is geared up to give a top speed of about 45 miles per hour. In ordinary service it will have to haul two 25-ton trailers, each carrying passengers. The body does not appear in the illustration as that is being made in the New Zealand Government workshops at Wellington. The eight-cylinder engine is of the "V" type, 7 inches bore by 8 inches stroke, and has a normal speed of 900 revolutions per minute and a maximum speed of 1,500 revolutions.



Gas-Electric Motor Car Hauling Trailing Load of 200 Tons. Car Shown Without Body.

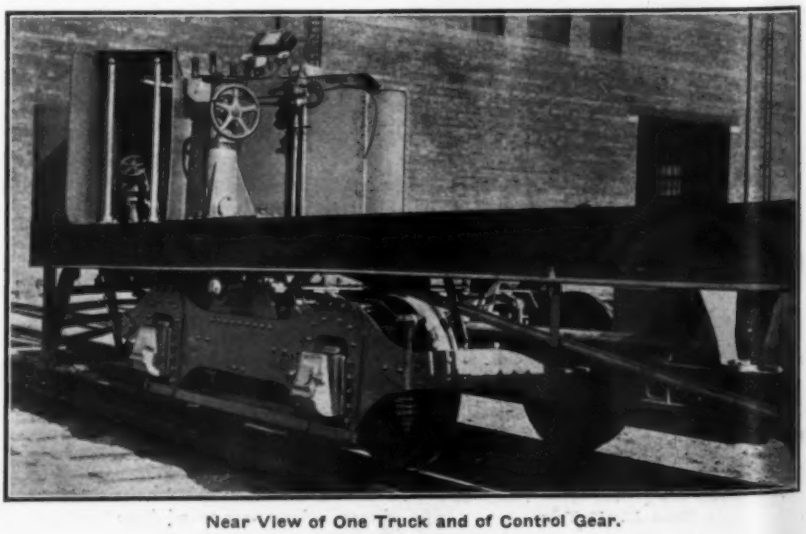
The transmission system is the particular feature of interest for electrical men. Briefly stated, the Thomas system comprises the use of two electrical machines (each about one-third the normal horsepower of the prime mover) and a planetary gearing which interconnects these electrical machines with the engine and the load. On top speed all the power is transmitted direct mechanically, and in starting, and in climbing heavy grades, part of the power is transmitted mechanically and part electrically. The division of the power at these periods, and the direct drive on top speed, give flexibility and efficiency. In the car illustrated the two electrical machines are totally inclosed and only weigh about 1,680 pounds each. The planetary gears are all cut double helical to ensure quiet and efficient running, and they are provided with forced lubrication, the oil being kept cool by means of an oil radiator. The chief novelty in the transmission is the use of magnetic clutches which are simple to control and suitable for large power.

The first electrical machine forms one complete unit with the planetary gearing and the two magnetic clutches. This unit is quite rigid and perfect alinement is thus assured. It transmits the mechanical drive to the outside axle of one truck. The second electrical machine is mounted independently of the engine and transmission unit referred to, as it drives the outside axle of the second truck purely electrically. Tubular Cardan shafts are provided for the drives to the two trucks, and suitable interposition of universal joints assures perfect uniform angular velocity.



Diagrammatic Arrangement of Thomas Transmission System for 200-Horsepower Motor Car.

The control of the car can be effected from either end. The main controller provides for 12 forward speeds, including direct drive on top. The reverse for continuous running is obtained by reversing the direction of rotation of the engine. Two reverse notches are provided in the controller for reversing for short distances when switching, etc., the power being transmitted purely electrically. This is effected by coupling up No. 1 machine direct to the engine and transmitting the power electrically therefrom to No. 2 machine, which is permanently coupled to one of the driving axles. In addition to the main controller an auxiliary switch is provided, which is used to control the car in much the same way as the clutch pedal on an ordinary touring car. There are two magnetic clutches: first the free-wheeling clutch, which is engaged for all running speeds, and second, the top-speed clutch which is engaged only for the direct drive, starting the engine, and emergency reverse. Both of these



Near View of One Truck and of Control Gear.

clutches can be disengaged by putting this auxiliary switch in the "off" position. To bring the vehicle to rest, therefore, it is not necessary to move the main controller, the act of freeing the engine being obtained by moving only the auxiliary switch lever.

In order to put the car in motion the control handle is moved into the "start engine" notch, which connects the battery across No. 1 machine (the battery is used purely for starting up the engine and lighting the car); the auxiliary switch is then closed, thus coupling No. 1 machine by means of the top-speed clutch direct to the engine. As soon as the engine has been started, the auxiliary switch is put into the "off" position and the main controller moved into No. 1 notch. By slowly bringing the auxiliary switch into the "on" position, the free-wheeling clutch is gradually engaged, thereby causing machine No. 1 to be driven round in the reverse direction to the engine. As the car gains speed, the main controller is gradually moved to the top-speed position, when the direct drive is obtained by engagement of the top-speed clutch, which locks the epicyclic gearing, and at the same time reduces the current generated to zero. The notch beyond top speed provides for charging the battery.

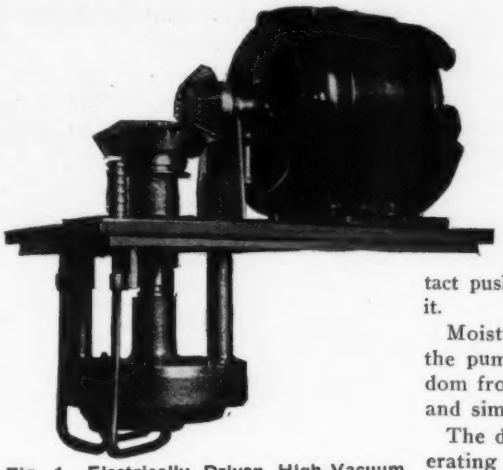
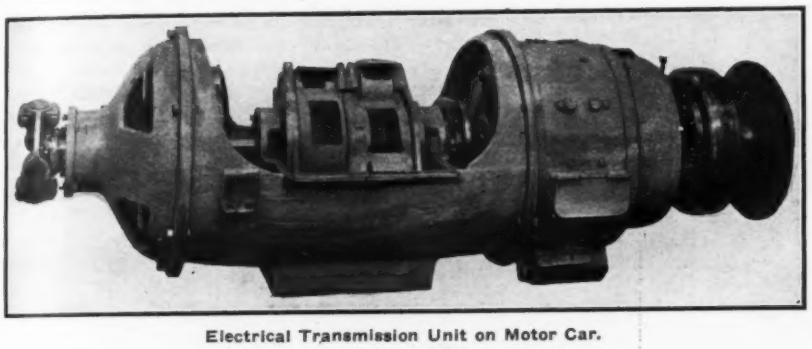


Fig. 1.—Electrically Driven High-Vacuum Pump.



Electrical Transmission Unit on Motor Car.

The car has a Westinghouse air-brake equipment, also emergency hand brakes. The complete vehicle, excluding the body, weighs 18 tons, the engine, transmission and radiators weighing about seven tons out of this. The car was designed and equipped throughout by the Thomas Transmission, Limited, 14 Leonard Place, High Street, Kensington, London, W., England.

New Electrically Driven High-Vacuum Pump.

The new May-Nelson oscillating-ring high-vacuum pump consists of four parts, the body, impeller, cover and shaft. Fig. 1 shows the pump with the cover removed.

In the body and impeller there are cut a series of concentric grooves so arranged that each of the rings thus formed in the impeller projects into a corresponding ring in the stationary half. In each of the grooves cut in the body, there are dividing walls, and the corresponding parts of the impeller rings are cut away.

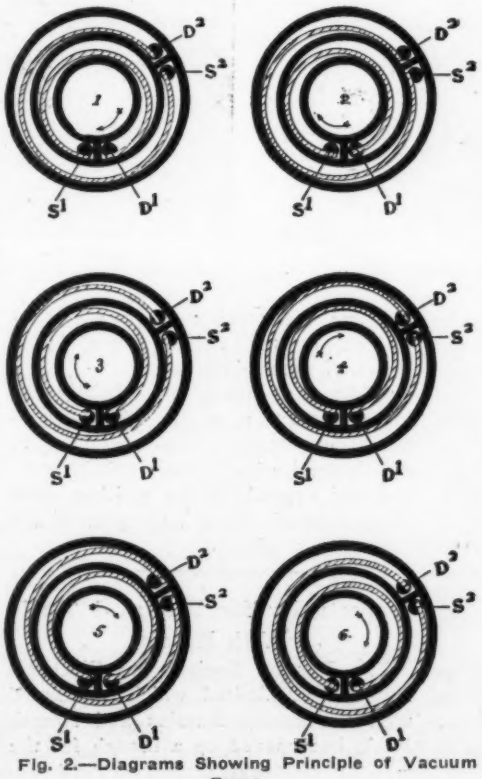


Fig. 2.—Diagrams Showing Principle of Vacuum Pump.

The two, three or whatever number of grooves there may be (depending upon the particular pump referred to) are connected in series by posts. The action of the pump depends on the rolling contact made between the external cylindrical surfaces of either piece and the adjacent internal cylindrical surfaces, the contact pushing the air and vapor ahead of it.

Moisture and liquid can pass through the pump without injury, and its freedom from valves make it a very robust and simple piece of apparatus.

The diagrams in Fig. 2 show the operating principle of the pump. The two cross-hatched rings represent the impeller and the solid rings represent the body of the pump. S^1 is the port connected to the vessel to be evacuated; D^1 is connected to S^2 and D^2 is the discharge.

The rotation of the shaft produces first an increase in size of the crescent-shaped space adjacent to S^1, thus drawing in the air. Then S^1 is closed off from the space by the further rotation of the impeller and D^1 is opened to it. The space now decreases in size, thus forcing the air out of D^1. S^2 draws the air away from D^1 and it is finally discharged out of D^2. Both sides of the impeller are effective; therefore, there are two double-acting rings working in series. The three ring pumps operate the same except that the air passes around a third ring in series with the other two before it is finally discharged.

The pump is made of cast iron throughout, and is equipped with bronze bearings. The outfit illustrated, Fig. 1, is a three-ring pump with a displacement of 930 cubic inches of free air per minute and the maximum vacuum is 0.25 millimeter. It is direct-connected to a one-tenth-horsepower motor made by the Robbins & Myers Company, Springfield, O. The gears are covered with a guard and the outfit sits in a tank which contains oil. The rear guard and tank are not shown in Fig. 1.

The over-all dimensions of the outfit are: length 12 inches, width 7 inches, height to top of motor, 13.75 inches. The weight with oil is 75 pounds. The pump is manufactured by the May-Nelson Manufacturing Company, Washington, D. C., and is sold through Eimer & Amend, New York City.

A good frosting for automobile headlights is had by coating the inside of the glass with saturated solution of Epsom salts, which is allowed to evaporate on the glass.

New Electrically Driven Tire Pump.

Among the many new devices that are constantly being exploited for use in the garage, the tire pump shown in the illustration is worthy of mention on account of several unique features.

The entire outfit is a self-contained unit mounted as shown. A handle is supplied, allowing it to be easily carried, or it can be mounted on a small carriage, if desired. The air pump, which is mounted on the motor, has four cylinders, insuring a steady flow of air. The corrugations on the cylinders assist in dissipating the heat generated by the compression of the air and keep the operating temperature low. Metal pistons, each fitted with two compression rings, are used, The connecting rods and main bearings are made of bronze. The motor used is the well known one-quarter-horsepower standard Westinghouse type CA or CD, depending on the nature of the circuit, whether alternating current or direct current.

Motor-Driven Tire Pump.

This pump is called the "Guco" and is manufactured by the General Utility Company, 1330 Ogden Street, Philadelphia, Pa. It will meet every "safety first" requirement; all electrical contacts are shielded and al working parts are inclosed, which, in addition to making it safe, makes is dustproof. All parts of the pump are lubricated by the splash system.

The complete equipment consists of a motor-driven pump, a pressure gauge, an air hose, an acorn connection and a snap switch for starting and stopping the motor.

Electric Storage Battery Sales Convention.

The eighth convention of the sales managers of the Electric Storage Battery Company, Philadelphia, Pa., was recently brought to a close after a week's session at the Bellevue-Stratford Hotel, Philadelphia. The managers of the New York, Boston, Chicago, Cleveland, San Francisco, Denver, St. Louis, Detroit, Pittsburgh, Atlanta, Washington, Rochester and Pennsylvania sales offices were in attendance.

The sessions opened each day at 9:30 a. m. and closed at 5:30 p. m., the president and general manager, Herbert Lloyd, presiding. Papers bearing upon the development of various fields of storage-battery service were presented by engineers and department heads of the general office and a number of subjects were discussed concerning important matters pertaining to the different territories.

While the convention was a hard working one the evenings were made attractive to the visiting force by a series of entertainments

While the convention officially adjourned at 5:30 p. m., Saturday November 13, important matters pertaining to certain territories necessitated the presence of several of the visiting managers through the greater part of the following week.

Opportunity for Electrical Trade With Russia.

The Russian Society for Electrical Enterprises, Limited, which is affiliated with the strong Russian and French Bank, has opened up a branch for the sale of electrical machinery and apparatus, insulating materials and supplies, also steam and oil engines and water turbines. It desires to enter into relations with first-class electrical manufacturers, with a view of becoming their agents in Russia, where there is considerable demand for electrical equipment, because former German sources are completely cut off. This firm owns the concessions for electric lighting sations in Pawlowsk, Uman, Kamenetz and Podelsk, and for electric railways in Elizabethgrad and Uman. Its address is 5 Marsowo Polje, Petrograd, Russia.

Loud-Speaking Telephone Window Demonstrations.

The drawback to window demonstrations of any character has been the inability of the demonstrator to get his "message across." He could clearly point out the talking points of the article under demonstration, but he could talk about it through the medium of lettered cards only. It is obvious that this method is very unsatisfactory. To overcome the objection and bring the demonstrator nearer his audience, the Western Electric Company has developed a loud-speaking telephone equipment in this connection.

Window Demonstration with Loud-Speaking Telephone.

This equipment consists of a special transmitter and a pair of loud-speaking receivers and horns. The operation is simple. The demonstrator connects the horns and receivers on both sides of his window, just high enough to be outside the reach of mischievous youngsters. In series with the transmitter, which is placed inside the window, is wired the battery of six dry cells connected in series and the receivers. The system is then ready for operation. As the demonstrator wishes to bring out each point, he simply speaks into the transmitter and his voice is magnified by the receivers and horns, and carried to the audience.

Electrical Equipment of New Factory of Holtzer-Cabot Electric Company.

A noteworthy feature of the factory equipment at the new plant of the Holtzer-Cabot Electric Company, Roxbury, Boston, Mass., is a distribution switchboard 30 feet long, that supplies energy to the various testing benches at voltages and frequencies of almost any conceivable combination. The board was designed and built by the company and consists of 12 panels, with 10 auxiliary machines in connection. There are 900 receptacles for plugging in leads to the benches, and current is available in volume up to 400 amperes, of any voltage between 5 and 575, direct current or alternating current and with frequency of 25 to 133 cycles single phase, and of 25 to 60 cycles, three phase. Each receptacle is provided with a fiber safety cap fitting, and the character of the energy it supplies is plainly painted in white on the black slate, the letters and figures being 1.25 inches high.

Adjoining the main board is a marble board for high-potential control, for testing at voltages ranging from 500 to 6,000. The first slate panel, which is five feet wide, controls 60 kilowatts in alternating-current auxiliaries which are connected to 75 horsepower in direct-current motors with slip rings on the back of the armatures, for three-phase current. The generator windings are arranged for series-parallel connection and for two and three-phase energy. The generator field is controlled through a motor-operated rheostat. The second slate panel, four feet wide, is for the same object, differing from the first only in the manner of making connections, these being by means of knife switches instead of by plug arrangement. The other 10 panels are each 26 inches wide and are fitted with plug receptacles, as noted.

Each bench has four main circuits for test connections, three circuits for field control of the booster, and a continuity-bell-test circuit.

Energy for power and light in the factory is obtained from the Boston Edison Company, whose 4,400-volt mains run into a brick transformer house, 16 by 24 feet, located in the yard. The main switchboard for the factory is located in a recess of the wall directly inside the factory.

Seven three-inch conduits run directly from the transformer house to the south end of the third floor, where is located the test department. The board is located over a narrow opening in the concrete floor slab, the wires being carried thence through conduit inbedded in the floor. On the board is a five-kilowatt single-phase autotransformer, arranged with ten taps which allow voltages to be varied from 110, or 220, in steps of five volts.

A 50-kilowatt rotary converter produces direct current at 110 and 220 volts, being arranged with an induction regulator in the primary circuit to vary the voltages. The motor-generators used are of Holtzer-Cabot manufacture.

Machines throughout the factory are motor-driven by 220-volt, three-phase, 60-cycle current. In the concrete floor slabs inserts were cast at four-feet intervals in both dimensions, as a means for attaching shafting and motors, through short sections of joist bolted to the ceiling. In general, the machines are operated in groups from motors of 5 to 20-horsepower each.

The new factory is designed to house the entire business of the Holtzer-Cabot Electric Company, formerly carried on at Brookline and in two lesser plants in Boston. The building is of brick-faced concrete, 300 by 60 feet, and six stories high with basement, a six-story annex 100 by 60 feet, and a 60 by 60 foot sub-basement used as a garage. The area of the walls of the superstructure is 60 per cent glass, thus affording abundant natural light. A boiler house 42 by 42 feet, with chimney 120 feet high, houses two 250-horsepower high-pressure boilers with necessary equipment to drive generators, should the company desire to generate its own electricity for power and light. At present, this plant supplies heating by the Warren Webster vacuum system, automatically controlled from the main office by a Powers regulating system.

New Factory of the Holtzer-Cabot Electric Company.

Water is obtained from wells and is pumped to two 6,000-gallon tanks on the roof of the factory by a triplex pump in the boiler room, automatically controlled by an electric float switch.

Sanitary appointments are thorough, and rest and accident rooms are provided for employees. Lighting of the workrooms is by means of incandescent lamps installed in bell-shaped glass near the ceiling. A complete direct-current wiring system provides for telephones and factory signals, connecting all departments with the main office.

The business of the Holtzer-Cabot Electric Company was established in 1875 by Charles W. Holtzer, and was incorporated in 1889. During the early period the products were chiefly house and hotel annunciators, bells and batteries. With the coming of the telephone a large new field was opened up, and at present the Holtzer-Cabot motor-generator is prominent in the power equipment of many leading telephone exchanges in America and also abroad.

The manufacture of motors was begun about 18 years ago, this company being a pioneer in the making of the alternating-current motor. The present output includes dynamos for lighting and electroplating, motors for all sorts of industrial and domestic uses, and interior telephones, watchmen's clocks, igniters, and electric horns. The company has designed and developed much special apparatus for United States Government departments.

Ore Company To Employ Electricity.

The directors of the Complex Ores Company, Limited, have contracted with the Hydroelectric Department of the State of Tasmania for the use of a large supply of electricity. This company was organized several years ago to treat zinciferous ores and manufacture carbides.

As the process requires cheap power, the concern organized the Hydroelectric Power Company of Tasmania, but after spending a large amount of money on the construction of a power plant at Lake Coleridge it was found that sufficient capital could not be secured to complete the work. The unfinished electric power plant was therefore sold to the State of Tasmania and is now being completed by the State Government. Power will be transmitted to Hobart and other towns throughout the island, which is located south of Australia, and is a State of the Commonwealth of Australia.

Production of Aluminum in the United States.

Aluminum production in the United States totaled 80 million pounds last year, against 15 million pounds in 1906 and only 83 pounds in 1883. This year's output may reach 100 million pounds, or about half the world's production.

Latest Approved Fittings

The electrical fittings illustrated and described in this department have been approved by the Underwriters' Laboratories, Incorporated, following examination and tests conducted under standards of the National Electrical Code as recommended by the National Fire Protection Association.

FIXTURE PARTS.—John D. Raymond, 1601 Fort Dearborn Building, Chicago, Ill.

Fixture parts of Raymo-Light Type C Units, consisting of glass bowls, reflectors, pendent chains, canopies, shadeholders and the like, for use with gas-filled lamps of 100, 200 and 300-watt capacities.

Catalog Nos. 2200, 2220, 2222, 2222B, 2300, 2330, 2333, 2333B, 2400, 2440, 2500, 2600, 2700.

Listed October 18, 1915.

FIXTURE PARTS.—Benjamin Electric Manufacturing Company, 120 South Sangamon Street, Chicago, Ill.

Fixture-supporting attachments for use with Benjamin ceiling fixtures and receptacles having threaded shadeholder shells.

660 watts, 250 volts, catalog Nos. 1413, 1416.

Listed October 27, 1915.

FLEXIBLE CORD.—A A Wire Company, Newark, N. J.

Marking: Two uncolored woolen threads parallel with conductor between rubber insulation and braid.

Cords shown by tests and examinations conducted by Underwriters' Laboratories to be in accordance with the requirements of the National Board of Fire Underwriters have labels attached to each coil.

Listed October 25, 1915.

GROUND CLAMPS.—M. I. Ginsburg, 104 North Sixth Street, Philadelphia, Pa.

Ground clamp for use with No. 4 B. & S. gauge wire. A single-piece clamp of copper, provided with suitably spaced holes and with a copper-plated bolt and nut for clamping to rigid conduit. Adjustable for use with conduit up to and including one-inch size. One end of clamp is channeled to form equivalent of a lug for soldering to ground wire.

Listed October 22, 1915.

PHOTOGRAPHIC PRINTING MACHINE.—Folmer & Schwing Division, Eastman Kodak Company, 12 Caledonia Avenue, Rochester, N. Y.

F. & S. Professional Printer, for printing photographs by incandescent lamps. A wood frame supports a metal-walled light chamber with lamp receptacles and control switches, and a special printing frame. Equipment includes a treadle-operated push-button switch for disconnecting all except one of the lamps when not in use, and a flexible cord with attachment plug for connection to supply circuit. 600 watts, 125 volts, No. 1.

Listed October 29, 1915.

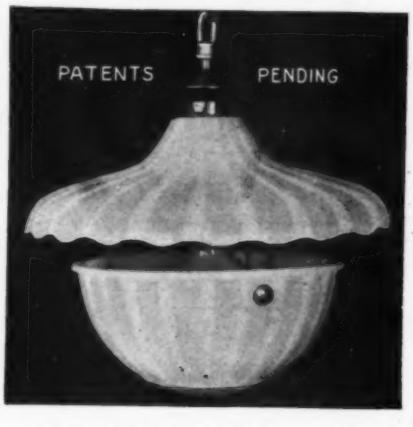
PICTURE MACHINES AND APPLIANCES.—The DeVry Company, 117 North Fifth Avenue, Chicago, Ill.

Portable hand-operated motion-picture machine having mechanism mounted in a three-ply veneer, asbestos-lined wood case. De Vry.

The electrical parts of this device comprise a 100-watt incandescent lamp of special form, with socket and portable cord for attachment to supply circuit.

Standard for use only with slow-burning film supplied by the manufacturer.

Listed October 25, 1915.



Fixture No. 2220.—John D. Raymond.

RECEPTACLES.—Candelabra and Miniature. The Bryant Electric Company, Bridgeport, Conn.

Bryant or Perkins, 75 watts, 125 volts.

Miniature, for decorative lighting systems. Christmas-tree lighting outfits and similar purposes. For indoor use only.

Sign, catalog Nos. 387, 389.

Cleat, catalog No. 366.

Listed October 25, 1915.

Weatherproof Receptacle No. 970.—Union Electric Company.

RECEPTACLES, Standard.—The Luminous Unit Company, submittor, 265 Washington Avenue, St. Louis, Mo. Manufactured by the Byrant Electric Company, Bridgeport Conn.

Keyless, porcelain shell. "L. U. Co."

Cleat, 660 watts, 250 volts, catalog No. 50.

1500 watts, 250 volts, catalog No. 100.

Fixture, 660 watts, 250 volts catalog No. 51.

Listed October 16, 1915.

RECEPTACLES, Standard.—Union Electric Company, Trenton, N. J.

Porcelain shell, 660 watts, 250 volts.

Sign or conduit-box type, catalog No. 704.

1,500 watts, 600 volts, cleat type, catalog No. 526; concealed type, catalog No. 527.

Listed November 1, 1915.

RECEPTACLES, Weatherproof.—Union Electric Company, Trenton, N. J.

Porcelain shell, 660 watts, 250 volts.

Conduit-box type, catalog Nos. 970-71.

Listed November 1, 1915.

ROSETTES, Fuseless.—The Bryant Electric Company, Bridgeport, Conn.

Bryant or Perkins, 3 amperes, 250 volts.

Molding, catalog No. BW-26.

Conduit box, catalog No. BX-26.

Listed October 25, 1915.

ROSETTES, Fuseless.—The Bryant Electric Co., Bridgeport, Conn.

Bryant or Perkins rosettes (with pull socket mechanism), 3 amperes, 125 volts, 1 ampere, 250 volts.

Molding, catalog No. BW-25.

Conduit box, catalog No. BX-25.

Listed October 26, 1915.

SOCKETS, Standard.—Benjamin Electric Manufacturing Company, 120 South Sangamon Street, Chicago, Ill.

Benjamin, brass shell.

Pull, 660 watts, 250 volts, catalog Nos. 4225-6, 4236-7.

Keyless, 1,500 watts, 600 volts, porcelain-lined, catalog Nos. 4297-9 inclusive, 4275, 4277. Electrolier, for fixture use only, catalog No. 444.

Porcelain shell.

Key, lever type, 250 watts, 250 volts, catalog Nos. 249, 4425-28 inclusive.

Keyless, 600 watts, 600 volts, catalog Nos. 256-7.

Listed October 23, 1915.

SWITCHES, Automatic.—Chicago Safety Appliance Company, 122 Michigan Avenue, Chicago, Ill.

Elevator safety control system, consisting of "Shreve" elevator door switches connected in series with coil of remote-control solenoid switch. Contacts of solenoid switch are in series with controller in car. Emergency switch in car is provided to shunt out solenoid switch in case of inoperation of door switches.

Listed October 25, 1915.

Current Electrical News

ATLANTIC STATES.

ST. ALBANS, VT.—The Vermont Power & Manufacturing Company, St. Albans, Vt., operating hydroelectric and steam generating plants and serving a large territory in northern Vermont with power and lighting, has been acquired by interests representing a new Massachusetts corporation, the People's Electric Lighting Company. The incorporators were J. W. Ogden, Malden; W. R. Dame, Clinton; W. H. Tylee, Worcester; D. V. Carruth, Clinton; A. G. Augur, Philadelphia, and H. B. Hodge, Boston. The officers are: President, W. H. Tylee; vice-president, W. H. Ogden; treasurer, W. H. Vorce, and on retirement of the latter the treasurership will be taken by Mr. Dame. W.

BROCKTON, MASS.—The Chamber of Commerce is considering a plan for the installation of an ornamental street lighting system on some of the principal streets at an estimated cost of $5,630.

BEAVER, PA.—Charters have been approved for seven new light companies for the establishment of lighting installations at Georgetown, Industry, Ohio, Center and Potter townships. Smaller plants will be located at Glasgow, a suburb of Smith's Ferry, and at Shippingport. The headquarters of the new lighting companies will be with the Beaver County Light Company. Address J. S. Magee.

GLENOLDEN, PA.—The H. K. Mulford Company will shortly erect a power house for its plant here. Thomas M. Seeds, Jr., 1207 Race Street, Philadelphia, Pa., is taking the subbids.

LIZARD CREEK JUNCTION, PA.—The Lehigh Valley Railroad Company proposes to erect large shops here. It is said that electric drive will be used throughout.

OAKMONT, PA.—The Autocar Company, of Ardmore, Pa., will erect a three-story brick and concrete building here. It is reported that all machines will be motor-driven. Stearns & Castor, Philadelphia, are the architects.

PHILADELPHIA, PA.—The Board of Education will erect a four-story school building at B and Westmoreland Streets. The cost will be about $350,000. J. Horace Cook is the architect.

PHILADELPHIA, PA.—In about one month the Misericordia Hospital will be ready for bids for the erection of the building and the machinery equipment of a power house to be constructed at Fifty-third and Cedar Streets. E. F. Durang & Son are the architects.

PHILADELPHIA, PA.—A twelve-story reinforced-concrete and steel office building will be erected here. The cost will be about $250,000. The lighting contract will be awarded separately. Robeson Lea Perot, 34 South Seventeenth Street, Philadelphia, is the architect.

FORT PIERCE, FLA.—Bonds have been voted for improving the electric light system. Address R. Whyte, mayor.

NORTH CENTRAL STATES.

CANTON, O.—The city council has finally determined on the use of electricity for the ornamental street lighting system on Tuscarawas Street, deciding that gas would be unsatisfactory. The Canton Electric Company will install the system under a five-year contract for maintenance, effective beginning January 1, 1915. L.

CINCINNATI, O.—Bids will be received until 12 o'clock noon, December 20, on the second section of the Eastern High School work, including the power house and equipment. C. W. Handman, business manager of the board of education, 511 West Court Street, should be addressed, and will furnish plans on deposit of $25. Separate bids may be submitted for the electrical work. L.

CINCINNATI, O.—H. Harig & Company have been awarded the general contract for the construction of a 10-story addition to the building of the Provident Savings Bank & Trust Company by Architect Harry Hake. It will cost $100,000, and will call for a considerable amount of electrical work. L.

MASSILLON, O.—H. O. Swoboda, Empire Building, Pittsburgh, Pa., has been retained as consulting engineer for the purpose of preparing plans and specifications for a new street lighting system.

ELKHART, IND.—The Board of Public Works will soon advertise for bids for the lighting of the city. Address president of the Board of Public Works.

SOUTH BEND, IND.—The city council is considering the question of establishing a municipal electric lighting plant. Address Mayor F. W. Keller.

AURORA, ILL.—Alderman James Sanders, of the city council committee on lights, will ask the city council to provide in the 1916 appropriation ordinance for an appropriation of $2,500 for electric lights. Address City Electrician Barclay.

ELGIN, ILL.—City Electrician E. A. Bell has completed plans for an ornamental lighting system on St. Charles Street. Z.

MARSEILLES, ILL.—The council will install decorative lights. Address town clerk.

ROCK FALLS, ILL.—Bonds amounting to $55,000 have been voted for an electric light system. Address town clerk.

LANNON, WIS.—The Lannon Light and Power Company has been incorporated with a capital of $15,000, by W. C. Leitzke, A. H. Christman and others.

MENOMONIE, WIS.—It is understood that the Wisconsin-Minnesota Light and Power Company is about to revive its project of building a power dam at Dunnville on the Red Cedar River. Application has been filed with the Railroad Commission asking for construction rights.

WASHBURN, WIS.—The Commercial Club is considering the question of a white way system along Main Street. Address chairman of Commercial Club.

HALLOCK, MINN.—A "white way" system will be established here. Address town clerk.

MONTROSE, MINN.—An electric light system will be built. Address town clerk.

BELLE PLAINE, IOWA.—Electric street lights will be installed here. Address city clerk.

ELDRIDGE, IOWA.—Otto R. Wuestenberg has been issued a permit for the installation of an electric light plant.

FAIRBANKS, IOWA.—Bonds in the sum of $6,000 have been voted for municipal lighting. Address city clerk.

IMOGENE, IOWA.—The council plans to secure electric lights. Address city clerk.

ORIENT, IOWA.—The council is considering the installation of a municipal electric light system. Cost $7,000. Address city clerk.

SPRINGFIELD, MO.—An election has been ordered by the city council for January 11, to vote on an issue of $400,000 in 20-year bonds for the building of an electric light plant.

KILDEER, N. D.—The Kildeer Electric Light and Power Company is planning to erect a power plant.

SOUTH CENTRAL STATES.

FLEMINGSBURG, KY.—An increase in the capital stock from $12,000 to $20,000 has been authorized by stockholders of the Flemingsburg Light and Ice Company. The money will be used to purchase and install a new generating equipment and to change over the lighting system from a direct to alternating current. This will enable the company to supply current to other towns in the county. The company has a bonded indebtedness of $6,000.

TUCKERMAN, ARK.—The Citizens' Light and Power Company will establish new electric light plant. Address general manager.

HEAVENER, OKLA.—Le Flore County has voted to issue $20,000 in bonds for the erection of a municipal electric plant. Erection of the plant will begin at once. Address county clerk.

DENTON, TEX.—With the money raised for the white way system about the courthouse square and on East

Hickory Street to the railroad station, agitation for extending the ornamental lights out West Oak Street to Fry Street in the residence section has been started.

GARLAND, TEX.—A crew of 50 men has started work here on the 33,000-volt transmission line of the Texas Power and Light Company, which will be built from Jenkins to Garland, Rockwall and Royse City. The crew will be divided and will work in both directions. It is expected to have the line finished in two months.

M'KINNEY, TEX.—At a popular election held on November 24, the people of McKinney voted to sell the local municipal plant to the Texas Power and Light Company. The sale includes a contract for electrification of the city water works.

PLAINVIEW, TEX.—The Malone Light and Power Company, including the plants at Plainview, Lubbock and Lockney, has been sold to the Texas Utilities Company, a new corporation recently organized in St. Louis, under Texas laws, with the principal office in Plainview, Tex. Approximately $230,000 was paid for the properties. Officers of the new corporation are H. Wurdack, St. Louis, president; H. C. Randolph, Plainview, vice-president; E. M. Kurtz, St. Louis, secretary-treasurer; Charles A. Malone, Plainview, general manager. Extensive improvements are contemplated.

PORTLAND, TEX.—At a mass meeting of citizens it was decided to issue bonds for the construction of an electric light plant. John W. Willacy, of San Antonio, can give information.

WINDOM, TEX.—The Board of Trade has contracted with the Texas Power and Light Company to put in street lights.

WESTERN STATES.

LIMON, COLO.—W. J. Cowhick, of Pueblo, has petitioned the city council for a franchise to install and operate an electric light plant in this town.

CHEYENNE, WYO.—C. A. Semrad, local manager of the Cheyenne Light, Fuel and Power Company, has completed plans and specifications for improvements to the local plant, estimated to cost about $50,000. The plans have been forwarded to the executive committee of the Western Power Company, at New York, the parent company. The proposed work involves the installation of new steam turbine and generator, boiler feed-water heater and feed pumps, automatic stokers, etc.

CHEYENNE, WYO.—According to S. B. Williams, chief of the Denver office of the United States Reclamation Service, private parties will shortly take steps for the construction of a gigantic water power and irrigation project in southern Montana and northern Wyoming, whereby a large amount of power will be developed and more than 100,000 acres of land reclaimed. The plans contemplate, he says, the utilization of the waters of the Big Horn River and the construction thereon of an immense reservoir for the storage of water. U.

WHEATLAND, WYO.—The city council has decided to expend between $6,000 and $10,000 for steam equipment at the city light plant. A new steam engine and two boilers will be purchased, and bids for the same will be called for at once. It is contemplated also to install a new electric generator in the near future. U.

CHOTEAU, MONT.—The city council is considering the installation of an ornamental street-lighting system, and it is planned to install 100-watt lamps with reflectors, on the corners in the residence district and ornamental lamp posts in the business district. Information in regard to this system can be obtained from the city clerk.

HEDGEVILLE, MONT.—Plans are being made for the installation of an electric light system. Address city clerk.

HELENA, MONT.—Residents of the Broadwater addition have petitioned the city council for the creation of a special improvement district in their section, which will provide for street grading, cement sidewalks, curbing and an ornamental street lighting system.

POLSON, MONT.—J. H. Cline has been granted a permit by the Interior Department for the construction of a hydroelectric plant on Big Creek in the Kalispell land district. He will utilize this plant for the purpose of furnishing electricity for municipal purposes in the town of Polson.

POCATELLO, IDAHO.—The city council is seriously considering the creation of several new lighting districts, and, accordingly, has instructed the city engineer to prepare maps, estimates, plans, etc., of the proposed districts to be created. Reported the council also considers a change in the street lighting from the cluster light to the single light type, although the making of this change is not assured.

ROBERTS, IDAHO.—The Utah Light and Power Company, which maintains Idaho offices at Idaho Falls, under the direction of W. C. Gates, general manager, will, according to reports, extend its transmission lines to this city, work to begin at an early date. The town of Roberts has granted the company a franchise and the company has petitioned the Public Utilities Commission at Boise for permission to make the extension. O.

ST. ANTHONY, IDAHO.—It is reported the council is considering the installation of a curbstone ornamental lighting system on Center and Bridge Streets, and has instructed the city engineer to prepare plans and estimates of the cost, and report back to the council at an early date. O.

MONTICELLO, UTAH.—There are strong indications that the efforts being made to install a waterworks system and electric light plant will prove successful. The stockholders of the Blue Mountain Irrigation Company have agreed to finance and install the proposed systems. Information may be obtained from the secretary of the company. U.

PROVO, UTAH.—The county commissioners of Utah County have granted a franchise to John D. Childs and others, to run a power, light and telephone line from Springville to Spanish Fork. Mr. Childs and his associates are planning to develop power and light near Springville. U.

TUSCON, ARIZ.—It is likely the city council will call an election early next spring to vote on a $50,000 bond issue for the installation of an ornamental street-lighting system.

NUEVO LAREDO (State of Tamaulipas), MEX.—General Luis Caballero, governor of this state, with headquarters at Victoria, has appropriated $5,000,000 Mexican silver, equivalent to about $2,500,000 United States currency, to be used in making public improvements here, including the construction of an electric light and power plant.

SAN FRANCISCO, CAL.—Articles of incorporation have been filed by the Great Western Power Company, with a capital stock of $60,000,000, divided into 600,000 shares of a par value of $100 each. Of this number 300,000 are preferred shares and 300,000 common. The incorporators are: Mortimer Fleishacker, Washington Dodge, James Irvine, P. W. Ham, W. F. Eccles, E. Mackennall and William Forrest, all of San Francisco; Guy C. Earl, W. H. Spaulding and Chaffee E. Hall, of Oakland; H. A. Cooke, of Easton; L. A. Reynolds, of Alameda, and J. A. Koontz, of Palo Alto. Incorporation is for a term of 50 years, and San Francisco is named as the principal place of business. This action, according to Mortimer Fleishacker, president of the existing Great Western Power Company, is the first step in a new financial plan whereby the old company and its subsidiaries, which include the City Electric Company and the California Electric Generating Company, will be amalgamated.

EUGENE, ORE.—The installation of an ornamental lighting system on Ninth Avenue to cost about $2,000 is being considered by the council, which has been petitioned for the improvement. O.

GRANT'S PASS, ORE.—W. B. Sherman has been granted permission by the state engineer to appropriate 1,000 second-feet of water of the Rogue River at Hell Gate for the development of an irrigation and power project, involving an expenditure of about $200,000.

STAYTON, ORE.—Reported the town of Sublimity, near here, has granted a 25-year light and power franchise to C. E. Taylor, of the Stayton Electric Light Company, also that the Stayton Electric Light Company has signed a five-year contract with the town of Sublimity for furnishing street lights and supplying current for same. It is understood work of constructing the extension and installing the lighting system will be started as soon as materials can be placed on the ground.

ABERDEEN, WASH.—The city council has again been petitioned by George H. Tilden, of Seattle, for an electric light and heating franchise in the city of Aberdeen, and, according to all reports, the second petition is being favorably considered by the council. Tilden some time ago filed a petition for a like franchise, but was refused same on the grounds that he could not produce proof that he could control a power site at Lake Cushman, where he purposed constructing a power plant for the generation of power to serve nearly every town in the Grays Harbor Country, including the towns of Olympia, Montesano, Chehalis, Aberdeen, Hoquiam, Cosmopolis, etc. Later the state courts ruled that Tilden and associates had prior filings and rights to the Lake Cushman site. According to reports Tilden and associates, who maintain offices in the Hoge Building, Seattle, will shortly begin construction

on the power plant at Lake Cushman and the erection of transmission lines throughout the territory to be served.

BREMERTON, WASH.—The Kitsap County Commissioners, at Port Orchard, have been petitioned by the Bremerton-Charleston Light and Fuel Company here for a franchise to construct, operate and maintain electric power transmission lines over certain county roads. O.

PORT ORCHARD, WASH.—The Paulsbo Light and Power Company, located on Liberty Bay, near this city, has been granted a franchise by the Kitsap County Commissioners to construct, operate and maintain electric transmission lines along certain county roads. The company will connect with the lines of the Olympic Power Company, which own and operate the Elwha power plant, the largest hydro-electric development in Kitsap county.

SEATTLE, WASH.—Recent advices from Dawson, Alaska, report that the power plant of the C. K. Mining Company, on Bear Creek, near Dawson, was totally destroyed by fire recently. The loss, unofficially, is given at a quarter of a million dollars. O.

VANCOUVER, WASH.—It is reported the North Coast Power Company is making preparations to construct a new power transmission line from this place to Woodland, via Ridgefield and LaCenter, this improvement necessitating the reconstruction of the transmission line from Woodland to Kalama. The line to be constructed from Vancouver to Woodland will connect the company's Vancouver power plant with others north of Woodland. As heretofore reported, this company recently assumed control of the properties of the Washington-Oregon Corporation, located in southwestern Washington. It is understood the company has other plans for extensions and improvements.

VANCOUVER, B. C.—Reported the city council will install a cluster lighting system in upper Tipperary Park, between Third and Fourth Streets, and that bids for the installation will be called for at an early date. Plans and estimates are being prepared by the city engineer. O.

FOREIGN TRADE OPPORTUNITIES.

[Addresses may be obtained from the Bureau of Foreign and Domestic Commerce, Washington, D. C., or its branch offices at Boston, New York, Atlanta, Chicago, St. Louis, New Orleans, Seattle and San Francisco. Write on separate sheet for each item and give file number.]

NO. 19,321. ELECTRICAL SUPPLIES.—A report from an American consular officer in Russia states that an organization has requested catalogs, price lists, samples, and terms from firms manufacturing electrical supplies, such as carbon for direct-current arc lamps; material for street lamps; switches; safety devices; sockets, with and without keys; meters, etc. Correspondence should be in Russian.

NO. 19,322. DOMESTIC LABOR-SAVING DEVICES.—An American consular officer in England reports that a firm desires to correspond with manufacturers of domestic labor-saving devices and novelties of various descriptions. References given.

NO. 19,325. ELECTRICAL APPLIANCES.—An American consular officer in the Canary Islands reports that a business man in his district desires to establish commercial relations, on a commission basis, with manufacturers of electrical appliances. Correspondence should be in Spanish.

NO. 19,330. COTTON INSULATION.—A firm in the United Kingdom informs an American consular officer that it is desirous of importing cotton yarn suitable for covering electric bell wire, electric-light flexible cords and cables. Samples of the yarn desired may be examined at the Bureau or its branch offices. (Refer to File No. 68,764 for sample.)

FINANCIAL NOTES.

C. Loomis Allen, former president of the American Electric Railway Association, was appointed co-receiver of the Empire United Railways, Incorporated, New York, and will take charge of the operation of the properties of the company. Hendrick Holden, of Syracuse, was appointed receiver of the company November 1. The bondholders' protective committee of the Rochester, Syracuse & Eastern, one of the companies involved, announced, November 25, that approximately $2,000,000 of the first mortgage five-per-cent bonds have already been deposited and the committee expects soon to have more than half of the issue of $4,896,000.

The Washington Water Power Company has provided for the maturity of $3,336,000 six-per-cent notes, due February 2, 1916, by the sale of $1,700,000 two-year five-per-cent notes, dated February 2, 1916, largely to holders of the maturing notes; and $1,700,000 first refunding mortgage five-per-cent bonds, due 1939. White, Weld & Company and Lee, Higginson & Company have purchased the bonds and are offering them at par and interest. This sale makes $6,408,000 outstanding of the authorized $15,000,000 first-refunding-mortgage bonds. Reserved bonds are issuable for additions and extensions at not to exceed 50 per cent of cost. Net earnings for the twelve months ended October 31 were over four and one-half times total annual interest charges on all bonds now outstanding. Since 1902, $13,243,700 stock has been sold by the Washington Water Power Company at par for cash. The property represents a cash cost in excess of $20,000,000 and there are less than $7,000,000 bonds outstanding against it.

Dividends.

	Term	Rate	Payable
Am. Pw. & Lt., com.	Q	1 %	Dec. 1
Baton Rouge Elec., com.	—	$2.00	Dec. 1
Baton Rouge Elec., pf.	S	$3.00	Dec. 1
Blackstone Val. Gas & Elec., pf.	S	$3.00	Dec. 1
Blackstone Val. Gas & Elec., com.	Q	$2.00	Dec. 1
Brooklyn Rapid Transit.	Q	1.5 %	Jan. 1
Chicago Telephone	Q	2 %	Dec. 31
Conn. River Pw., pf.	S	3 %	Dec. 1
Indianapolis St. Ry.	S	3 %	Jan. 1
Louisville Gas & Elec., pf.	Q	1.5 %	Dec. 20
Louisville Traction, com.	Q	1 %	Jan. 1
National Carbon, com.	Q	1.5 %	Jan. 16
Pennsylvania Ltg., com.	S	1 %	Dec. 1

Reports of Earnings.

WESTERN POWER COMPANY.

	1915	1914
October gross	$ 295,472	$ 227,598
Net	206,029	172,254
Surplus after charges	90,048	70,002
Ten months' gross	2,424,116	2,206,521
Net	1,856,120	1,645,367
Surplus after charges	790,060	645,741

COMMONWEALTH POWER, RAILWAY & LIGHT.

	1915	Per cent gain over 1914
October gross	$ 1,245,866	5.19%
Net after taxes	664,270	8.30%
Surplus after charges	222,328	16.96%
Balance after preferred dividends	142,328	29.29%
Ten months' gross	11,650,885	1.49%
Net after taxes	6,042,916	2.90%
Surplus after charges	1,741,547	0.64%
Balance after preferred dividends	941,547	1.19%
Twelve months' gross	14,173,088	0.54%
Net after taxes	7,415,127	3.04%
Surplus after charges	2,254,850	0.71%
Balance after preferred dividends	1,294,850	1.24%

PACIFIC GAS & ELECTRIC.

	1915	1914
October gross	$ 1,567,353	$ 1,409,694
Net after taxes	660,083	591,617
Total income	696,967	613,297
Surplus after interest	357,143	246,551
Balance after amortization	343,428	206,184
Ten months' gross	15,291,114	13,919,995
Net after taxes	6,554,682	5,719,084
Total income	6,855,084	5,960,875
Surplus after charges	3,377,431	2,008,763
Balance after preferred dividends	2,376,715	1,393,779

Gross for October, 1915, includes $31,667 in dispute because of rate litigation as compared with $29,668 in October, 1914, while the ten months gross includes $330,483 in dispute as compared with $489,181 in 1914.

NORTHERN STATES POWER.

	1915	1914
October gross	$ 461,427	$ 389,109
Net	271,560	222,514
Ten months' gross	4,073,600	3,603,191
Net	2,257,398	1,924,531

NEW INCORPORATIONS.

BOONEVILLE, ARK.—The Booneville Light and Power Company has been incorporated with a capital of $50,000. C. S. Greenway is president.

NORTH PLEASANTON, TEX.—The North Pleasanton Ice and Electric Company has been incorporated with a capital of $30,000, by L. B. Myers and others.

NEW YORK, N. Y.—W. & B. Electrical Contracting Company, Inc. Capital $1,000. Incorporators: Samuel Wallenstein, Saul Wallenstein and Chaim Bravo.

AUGUSTA, ME.—The Union Light & Power Company has been incorporated with a capital of $50,000, by Ernest L. McLean, Frank E. Southard and others.

CLOSING BID PRICES FOR ELECTRICAL SECURITIES ON THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

	Nov. 29.	Nov. 22
American Tel. & Tel. (New York)	128½	128½
Commonwealth Edison (Chicago)	143¾	144
Edison Electric Illuminating (Boston)	241	240½
Electric Storage Battery common (Philadelphia)	67	67
Electric Storage Battery preferred (Philadelphia)	67	67
General Electric (New York)	176	174⅞
Kings County Electric (New York)	125	125
Massachusetts Electric common (Boston)	7	7
Massachusetts Electric preferred (Boston)	39	39
National Carbon common (Chicago)	150	146
National Carbon preferred (Chicago)	119¾	120
New England Telephone (Boston)	132	132
Philadelphia Electric (Philadelphia)	27½	27¾
Postal Telegraph and Cables common (New York)	80½	80
Postal Telegraph and Cables preferred (New York)	65	65
Western Union (New York)	88	87¾
Westinghouse common (New York)	69¾	67½
Westinghouse preferred (New York)	—	—

ST. LOUIS, MO.—The T. C. White Electrical Supply Company has been incorporated with a capital stock of $10,000, to do a general electrical supply business.

BROOKLYN, N. Y.—Electric Case Company, Inc. Manufacturing metal novelties, etc. Capital $20,000. Incorporators: Roy A. Pierce, Lewis J. Morrison and Florence M. Greer.

NEW YORK, N. Y.—Thistle Electric Company, Inc., November 24, 1915. Manufacture electrical devices, etc. Capital $10,000. Incorporators: Boyd Thistle, Richard H. Fehler and Willard D. Bass.

NEW YORK, N. Y.—Mine Equipment Corporation. Manufacturing electric appliances for use in mines, drills, etc. Capital, $250,000. Incorporators: James G. Shepherd, L. Ward Prince and Michael J. Murphy.

NEW YORK, N. Y.—The Home Engineering Company, Inc., electric fixtures, etc. Capital, $12,000. Incorporators: George Tiernan, Frank H. Parcells and John B. Purcell, all of 64 Wall Street, New York City.

MADISON, WIS.—Articles of incorporation have been filed by the Southern Wisconsin Electric Company. The company is capitalized at $100,000. Incorporators: John B. Sanborn, Chauncey E. Blake and J. P. Alberg.

CHICAGO, ILL.—The Rotary Electric Sign Company has been incorporated. The company's capital stock is $10,000, and it is to manufacture and deal in electric signs and electric appliances. P. M. Gunnell, Thyra Carlson and Harold J. Finder are the incorporators. Z.

WILMINGTON, DEL.—The Pocock Safety Lamp Company has been incorporated for the purpose of manufacturing electric safety lamps. The capital is $500,000. Herbert E. Latter, Norman P. Coffin, Wilmington, Del., and Clement M. Egner, Elkton, Md., are the incorporators.

PERSONAL MENTION.

MR. E. W. BOND, traveling the Oklahoma and Kansas territory for the Bryan-Marsh Division of the National Lamp Works of the General Electric Company, was married to Miss Eunice Dimelow, of York, Pa., at Chicago, Ill., on November 24. They will make their residence at Hutchinson, Kans.

MR. ALFRED P. WATERMAN, who is in charge of advertising and publicity for the Holtzer-Cabot Electric Company, Boston, Mass., recently completed 25 years in the company's service. The occasion was signalized by the gift of 25 American Beauty roses from the president, Mr. Holtzer.

MR. HENRY I. HARRIMAN, vice-president of Chace & Harriman, Inc., Boston, industrial engineers, connected with the hydroelectric enterprises on the Deerfield River in Massachusetts, and the Connecticut River Transmission Company, has been chosen second vice-president of the Boston Chamber of Commerce.

OBITUARY.

MR. W. T. JACKSON, for many years a representative of G. M. Gest, engineer and contractor, died November 13, at Atlantic City, N. J. Mr. Jackson was well and favorably known in the Middle West and in the South, by all interests who have had any conduit construction done within the past twelve years. He was of a cheerful and robust personality, and made many friends, and in his business tranactions was known for his integrity and fair dealings. A nervous breakdown followed by a complication of diseases was the cause of his demise. He was buried in Cincinnati from the Scottish Rite Cathedral on November 17. Mr. Jackson was a member of the Chicago Athletic Club and of the Young Men's Business Club of Cincinnati.

MR. JAMES I. AYER, manager of the Simplex Electric Heating Company, Cambridge, Mass., and one of the pioneers in the electric cooking and heating industry, died at his home in that city November 26. Death was caused by heart failure, and was very sudden, Mr. Ayer having been at his office earlier the same day. Two years ago he suffered from a severe illness, but had apparently completely recovered his normal health. Mr. Ayer was born in Medford, Mass., in 1854, and received his early education in that city, in the public schools. When 22 years of age he married and with his wife, who was Miss Lillian Cleveland, of Melrose, Mass., went to Mattoon, Ill., removing thence to Indianapolis and later to St. Louis. After 20 years' residence in the Middle States he returned to Malden, later removing to Cambridge. His business career in electrical appliances began in 1896, when he manufactured electrical heating devices in a small building at Cambridge. His associates, who had become discouraged at the slow progress of the industry and the tardiness with which the public took up the devices, left Mr. Ayer to pursue his chosen field alone. By persistence and determination he overcame all obstacles and built up a business which is one of the largest and most successful of the kind in the country. He was a member of the Engineers' Club, Boston, and had been president of the National Electric Light Association. Three daughters survive, besides the widow.

DATES AHEAD.

American Society of Mechanical Engineers. Annual meeting, New York City, December 7-10. Secretary, Calvin W. Rice, 29 West Thirty-ninth Street, New York City.

National Independent Telephone Association; Independent Telephone Association of America. Joint convention, Hotel La Salle, Chicago, December 8-10. Secretaries, F. B. MacKinnon, Washington, D. C., and W. S. Vivian, 19 South La Salle Street, Chicago, Ill.

American Association of Engineers. First annual convention, Hotel La Salle, Chicago, Ill., December 10-11. Secretary, Arthur Kneisel, 29 South La Salle Street, Chicago, Ill.

American Association for the Advancement of Science. Annual meeting, Columbus, O., December 27-31. Secretary, L. O. Howard, Washington, D. C.

American Institute of Chemical Engineers. Winter meeting, Baltimore, Md., January 12-15, 1916. Secretary, J. C. Olson, Cooper Union, New York, N. Y.

Electrical Contractors' Association of Wisconsin. Annual convention, Hotel Wisconsin, Milwaukee, Wis., January 17-19, 1916. Secretary, Albert Petermann, 626 Lloyd Street, Milwaukee, Wis.

With the Electrical Manufacturers

The Robbins & Myers Company, Springfield, Ohio, announces that its San Francisco office, in charge of C. R. Hunt, has moved to 701-702 Rialto Building.

Harry Hubbell, Incorporated, Bridgeport, Conn., has issued circular No. 156 on Hubbell interchangeable attachment plugs and T-slot receptacles. Over 20 different types of these convenient and safe devices are shown. The value of having wall, floor and other receptacles liberally provided in every room is well pointed out, also the advantages obtained by the interchangeable T-slot construction.

The Appleton Electric Company, 212 North Jefferson Street, Chicago, announces the opening of a branch office at 1007 Pine Street, St. Louis, Mo., in charge of R. V. Hawkins. The company has just issued bulletin No. 7-A, which is a supplement to catalog No. 7. This bulletin illustrates and describes interesting additions to the Appleton line of steel Unilets and conduit fittings. Copies will be furnished to those interested upon request.

Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has issued a number of new leaflets, of which No. 3859, on "Mine Suspensions and Clamps," describes and illustrates a number of trolley fittings adapted for mine work. Motor-generator sets are described in leaflet No. 3742-A; sets from 2 to 200 kilowatt capacity, consisting of squirrel-cage induction motors and direct-current generators, are referred to.

Standard Underground Cable Company, Pittsburgh, Pa., has issued bul-

letin No. 540-1 on Standard motor cables for motor cars, motor cycles, motor boats, aeroplanes and stationary gas engines. Included in this line is an assortment of ignition, lighting and starting cables made up in various insulations and groupings to meet all conditions. Cable assemblies in harnessed form complete with terminals are also made up to specifications to fit any car.

King Foundry Company, St. Joseph, Mo., has ready for distribution copies of a neatly illustrated folder on King Monolite standards for the lighting of streets, boulevards and parks by means of series type C Mazda lamps. About a dozen different designs are shown, each equipped with General Electric Novalux units ranging from about 100 to 1,000 candlepower. These ornamental posts are furnished as complete units, ready to set up and connect to the circuit. The folder also gives valuable information regarding Novalux ornamental outdoor lighting units.

The Standard Paint Company, Woolworth Building, New York City, the manufacturer of P. & B. insulating tape, has just placed on the market a rubber friction tape, under its "Imp" brand. The Imp friction tape will not compete with or in any way displace the P. & B. tape, which is especially adapted for work in mines and weather-exposed locations. Imp tape is treated with rubber compound and finished by the friction process. It is suitable for all kinds of wiring work. The company is prepared to make quotations and insure prompt deliveries.

Central Electric Company, 320-326 South Fifth Avenue, Chicago, Ill., has issued a special catalog of electrical appliances particularly suitable for the Christmas trade. Included in this line are such appropriate electrical gifts as toy dynamos and motors, postcard projectors, electric lanterns and bicycle lamps, miniature electric railway sets, toy transformers, portable lanterns and flashlights, junior electric range, electrically lighted clock, Christmas-tree lighting outfits, flatirons, toasters, heating pads and other heating appliances, self-winding clocks, vibrators, sewing-machine motors, vacuum cleaners, washers, also automobile accessories.

The Pelton Water Wheel Company, San Francisco, has issued a bulletin on the utilization of the power of small streams. The many ways in which such power can be successfully used are pointed out and seven different installations are illustrated and briefly described. How to measure the flow of a stream by means of a weir is explained, also how to determine the head available and the length of flume or pipe. With these measurements and a knowledge of what the power is to be used for, the company is enabled to recommend the best type and size of Pelton wheel for the particular case. The outside of the bulletin is illustrated in attractive colors. It is issued in English, Spanish and Portuguese.

Hamilton-Beach Manufacturing Company, Racine, Wis., has ready for distribution a very handsome circular of Christmas suggestions, which portrays the well known electrical devices of the company in a manner that cannot help but appeal to the housewife. The circular is really one large sheet, 26 by 32 inches, so folded that it represents six double pages. Each page is decorated with a border of holly, which gives it a distinct Christmas atmosphere. The "Sew-E-Z" sewing-machine motor, which fits any machine, is given prominence as an admirable gift for the housewife. Illustrations show how it is operated, attached to and removed from the machine. Electric vibrators of four different types, ranging in price from $10 to $25, are shown in suitable carrying cases, which emphasizes the utility and suitability of these devices for Christmas giving. In the same class are hair driers and curling irons, which are also attractively displayed. In addition, the Cyclone shoe drier and the Cyclone drink mixer, two popular specialties of the company, are illustrated and described.

Record of Electrical Patents

Issued by the United States Patent Office, November 23, 1915.

Prepared by Thomas Howe, Patent Attorney, 2 Rector Street, New York, N. Y.

1,161,021. **Automatic Starter for Electric Motors.** L. Bradley, Milwaukee, Wis. Shunt magnet controlling resistance governed by series relay.

1,161,025. **Railway Car.** G. W. Carr, St. Louis, Mo. Gearing of motor.

1,161,035. **Signal-Lamp System for Cars.** C. C. De Witt, Shrewsbury, Mo. Signal lamps indicate when trolley has jumped wire.

1,161,036. **Electric Fuse.** L. W. Downes, Providence, R. I. Knife-blade end cap for cartridge fuse.

1,161,046. **Electric-Switch Wall Case.** M. Guett, assignor to Hart & Hegeman Mfg. Co., Hartford, Conn. Improved attaching means.

1,161,048. **Telephone System.** H. L. Harris, assignor to Garford Mfg. Co., Elyria, O. Exchange switchboard with provision for selecting one of the substation lines as an attendant line.

1,161,068. **Time-Controlled Switch.** R. Murray, Agenda, Kans. Clock-operated.

1,161,073. **Electric Relay.** H. A. Parrish, Kalamazoo, Mich., assignor of one-tenth to G. E. Dunbar. Arrangement of magnets, levers and contacts in casing.

1,161,080. **Insulator.** F. M. Spicer, Quincy, Mass. Body is loose and rotatable on pin; cap is screwed to pin.

1,161,081. **Hanger for Trolley Wires.** W. C. Starkey and G. H. Bolus, assignors to Ohio Brass Co., Mansfield, O. Catenary hanger of metal strap.

1,161,082. **Testing Device.** E. S. Stewart and C. D. Stewart, Ottawa, Ill. Portable magneto set for telephone-fault location.

1,161,096. **Lamp Holder.** H. E. Whitney, assignor to Dover Stamping & Mfg. Co., Portland, Me. Stamped support and contact springs for incandescent lamp in sheet-metal container.

1,161,105. **Printing-Telegraph Receiver.** C. G. Ashley, assignor to General Engineering & Construction Co., Ltd., Toronto, Can. Electromagnetically operated printing pens.

1,161,118 and 1,161,119. **Lighting Fixture.** A. C. Einstein, St. Louis, Mo. First patent: semi-indirect with top reflector of pane of ground, corrugated glass. Second patent: has translucent cylindrical body between top ventilating cap and conical reflector.

1,161,126. **Selector for Telephone Plants.** G. Grabe, assignor to Siemens & Halske A. G., Berlin, Germany. Has electromagnetic escapement with means for preventing overrunning of zero position.

1,161,130. **Indicator for Vehicles.** L. J. Horan, Detroit, Mich. Direction-indicator comprising electric audible signal and electric illuminated and operated signal arms.

1,161,142. **Wireless Communication.** C. V. Logwood, assignor to Federal Telegraph Co., Palo Alto, Cal. Receiving system with special resistance-varying device.

1,161,145. **Shoe-Polishing Machine.** L. Maire, Bonnots Mill, Mo. Motor switch interlocked with clutches driving brushes.

1,161,146. **Electric Heating-Pad.** N. E. Mann, assignor to Reliance Electric Heating Co., Columbia, Pa. Has thermally controlled resistor.

1,161,150. **Combined Bushing and Clamp for Electric Cables.** O. Moessner, Philadelphia, Pa. For use in outlet boxes.

1,161,173. **Arc-Lamp Electrode.** E. J. Watzl, assignor to National Carbon Co., Cleveland, O. Contains chemically united oxides of tungsten, titanium and rare earths.

1,161,175. **Attachment for Headlights for Automobiles.** E. O. Wheeler, assignor to Springfield Auto Deflector Co., Springfield, O. Light deflector for lamp bulb.

1,161,191. **Process of Mounting Objects.** F. B. Cook, assignor to Frank B. Cook Co., Chicago, Ill. Manner of forming contacts from strip material and mounting the same.

1,161,192. **Mounting Structures for Electrical Conductors.** F. B. Cook, assignor to Frank B. Cook Co. Conducting strips and mounting insulations formed in gangs and broken apart.

1,161,193. **Process of Making Spring Jacks.** F. B. Cook, assignor to Frank B. Cook Co. Manner of assembling component parts.

1,161,194. **Process of Making Connecting Plugs.** F. B. Cook, assignor to Frank B. Cook Co. Contacts positioned and secured by flowing insulation about them.

1,161,195. **Lightning-Arrester.** F. B. Corey, Edgewood, Pa. Reactance in series with number of spark gaps neutralized when equal current in each.

1,161,196. **Telephone-Exchange System.** E. R. Corwin, assignor to Frank B. Cook Co. Arrangement of link connectors.

1,161,214. **Telephone-Exchange System.** E. E. Hinrichsen, assignor to Western Electric Co., New York, N. Y. Common-battery and magneto telephone lines terminate at local position of board.

1,161,226. **Electroplating Apparatus.** W. F. Koken and H. J. Richards, St. Louis, Mo. Cathodes travel through solution between groups of anodes.

1,161,233. **Starting Switch.** S. J. Leveen, assignor to Trio Mfg. Co., Rock Island, Ill. Casing inclosing fused switch cannot be opened except when switch is in "off" position.

1,161,234. **Sifting Apparatus.** W. Lindsay, Chicago, Ill. Screen vibrated by electromagnet.

1,161,238. **X-Ray-Control Device.** W. Meyer, Chicago, Ill. Mechanism for resistance control of intensity of ray discharge.

1,161,278. **Automatic Circuit-Breaker.** A. R. Anderson, Columbus, O. Is automatically reclosed on restoration of normal conditions.

1,161,299. **Magnetic Separator.** R. M. Folsom, assignor to New England Gas & Coke Co., Reading, Mass. Cylinder has magnetizable member for moving magnetic particles from field.

1,161,320. **Electrical Protective Device.** A. J. Loguin, assignor to Allis-Chalmers Mfg. Co., Milwaukee, Wis. Time-limit circuit-breaker.

1,161,322. **Primary Electric Battery.** G. A. Lutz, Plainfield, N. J. Battery elements and depolarizer in unitary structure suspended from cover.

1,161,341. **Time Stamp.** A. A. Radtke, assignor to Electric Time Recorder Co., Chicago, Ill. Movement of time train transmitted to type wheels through electromagnetic setting mechanism.

1,161,349. **Electric Governor.** M. L. Severy and G. B. Sinclair, assignors to Choralcelo Co., Boston, Mass. Electromagnetic device for maintaining uniform speed of driven member.

1,161,351. **Magnetic Ore-Separator.** S. N. Smith, assignor of one-half to H. W. Hoops, New York, N. Y. Special provision for distributing material in pan beneath magnetic drum carrying endless apron.

1,161,361 and 1,161,362. **Electric Switch.** A. A. Tirrill, Schenectady, N. Y. First patent: special pull-operated snap switch. Second patent: pull switch with position indicator.

1,161,366. **Process of Welding Metals.** S. W. Wohlrab, Maple Falls, Wash. Metal

particles fed to arc in presence of non-oxidizing gas.

1,161,385. Electric Pump. A. E. Hall and G. H. Fraser, assignors to Automatic Electric Pump Co., New York, N. Y. Pump-driving worm gearing.

1,161,395. Volt-Ampere Meter. P. M. Lincoln, Pittsburgh, Pa. Elements operated by watt and wattless currents, respectively, jointly operate indicator.

1,161,397. Brush-Holder. L. R. Lord, Delagua, Colo. Box and pressure devices for carbon brush.

1,161,398. Storage Battery. J. O. Luthy, San Antonio, Tex., assignor of one-half to Y. Hicks. Electrolyte contains approximately one per cent of silver chloride.

1,161,400. Igniting Device for Explosive Engines. W. J. Martin, Buffalo, N. Y., assignor of one-half to W. McIntyre. Spark plugs of a magazine may successively be brought into operation.

1,161,411. Telephone-Exchange System. L. Polinkowsky, assignor to Western Electric Co. Arrangement of test and driving circuits for selector switch.

1,161,413. Vegetable-Paring Machine. H. Robinson, South Orange, N. J. Mounting and gearing of electric driving motor.

1,161,419. Method of Welding. E. E. Slick, Johnstown, Pa., assignor of one-half to L. L. Knox. Butt-welded edges are upset and extra metal fed between them, the joint remaining thick.

1,161,421. Trolley-Finder. D. P. Solomon, Berkeley, Cal. Normally horizontal finding fingers on harp pulled into upright position by rope.

1,161,425. Alternating - Current Vapor Lamp. P. H. Thomas, assignor to Cooper Hewitt Electric Co., Hoboken, N. J. Rectifier has special starting cathode and smoothing reactance for load circuit.

1,161,434. Magneto-Electric Machine. F. Baier, assignor to Swiss Magneto Co., Buffalo, N. Y. Has removable distributor plate and arrangement of brushes therefor.

1,161,441. Table - Actuating Mechanism for Rolling Mills. F. C. Biggert, Jr., assignor to United Engineering & Foundry Co., Pittsburgh, Pa. Motor automatically controlled by position of roll to adjust position of table.

1,161,454. Method of Making Electric-Light Streamers. J. A. Covit, New York, N. Y. Lamp sockets connected along circuit wires at intervals and molded thereto. (See cut.)

1,161,461. Self-Firing Explosive Bomb. J. Dodgson, Seattle, Wash. Buoyant structure releasably held submerged has electromagnet on upper end and timed electric ignition.

1,161,474. Trolley-Wire Clamp. W. D. Hall, Port Huron, Mich. For clamping and suspending trolley wire.

1,161,477. Circuit-Controller. A. J. Horton, assignor to Cutler-Hammer Mfg. Co., Milwaukee, Wis. Push-button-operated two-way switch member locked in "off" position or limited to operation with one contact only.

1,161,485. Vapor Electric Device. M. A. E. Leblanc, assignor to Cooper Hewitt Electric Co. Structure of W shape has provision for preventing unequal accumulation of mercury and short-circuits.

1,161,500. Selecting Mechanism. B. F. Merritt, assignor to Western Electric Co. Keyboard selecting equipment.

1,161,520. Quenched Spark Gap. R. Pfund, New York, N. Y. Special structure of spark-gap unit.

1,161,543. Continuous Brake. W. R. Smith, assignor of one-third to R. P. Wilson, and one-third to Consolidated Brake & Engineering Co., Ltd., London, England. Electrically controlled continuous pneumatic brake is applied when current falls below a certain value.

1,161,555. Igniter for Internal-Combustion Engines. J. A. Warren, assignor to Splitdorf Electrical Co., Newark, N. J. Particular structure of movable electrode of make-and-break igniter.

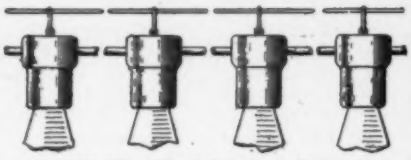
1,161,565. Automatic Train Control. R. G. Whipple, Chicago, Ill. Details of steam and air-brake control in electric block, train-stop system.

1,161,568. Apparatus for Determining the Period of a Pendulum. O. L. Wills, Portland, Ore. Comprises a Geissler tube in circuit with a standard clock.

1,161,575. Prevention of Disturbing Vibration. A. Aichele, assignor to Aktiengesellschaft Brown, Boveri & Cie, Baden, Switzerland. Stator of dynamo machine is elastically supported on foundation.

1,161,576. Liquid Resistance. A. Aichele, assignor to Akt. Ges. Brown, Boveri & Cie. Evaporated liquid is condensed and returned to tank.

1,161,582. Electrical Fitting. W. F. Anklam, assignor to C. M. Hall Lamp Co., Detroit, Mich. Tubular fitting has lamp at one end and plug at other, connection



No. 1,161,454.—Electric-Light Streamer.

being made and broken by axial adjustment of plug.

1,161,585. Electrolytic Production of Sodium Alloys. E. A. Ashcroft, London, England. Molten sodium hydroxide electrolyzed between electrodes of molten heavy metal at 400°C.

1,161,594. Circuit-Closer. J. E. Bishop, Fitzgerald, Ga. Particular structure of spring contacts held open by fuse.

1,161,595. Heating System. E. F. Bliss, assignor to General Electric Co., Schenectady, N. Y. Combination of groups of units of different heat generating capacities having the energy supplied to them respectively reduced by intermitting the current supply.

1,161,602. Overflow Trunking System. C. C. Bradbury, assignor to Western Electric Co. Groups of switches in automatic telephone system have overflow switches making available to each group idle secondary switches of other groups.

1,161,608. Semi-Mechanical Telephone-Exchange System. A. M. Bullard, assignor to Western Electric Co. Party-line system.

1,161,615. Call - Distributing Telephone System. H. P. Clausen, assignor to Western Electric Co. Arrangement of line-finder switches and indicators.

1,161,634. Electric Furnace. A. Dow, Detroit, Mich. Resistor bed in bottom of furnace has current magnetically deflected to its surface.

1,161,639. Loud-Speaking Receiver. H. C. Egerton, assignor to Western Electric Co. Electromagnetic structure for telephones.

1,161,655. Automatic Telephone Exchange. C. L. Goodrum, assignor to Western Electric Co. Interconnection of subscribers' lines to finder switches.

1,161,656. Protective Device. V. E. Goodwin, assignor to General Electric Co. Lightning arrester comprising aluminum-type electrolytic condenser submerged in oil.

1,161,663. Time - Controlled Protective System for Railways. C. Hansel, Cranford, N. J. Arrangement for track crossing in block system.

1,161,667. Electric Heating and Cooking Stove. L. P. Hays, Idaho Springs, Colo. Special provision for air circulation through cylinder containing heater.

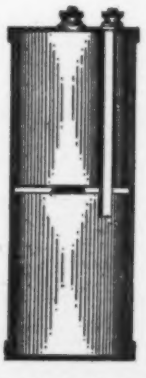
1,161,668. Electric Battery. G. P. Heinrich and J. E. Dunn, assignors to Interstate Electric Novelty Co., New York, N. Y. Superposed dry cells in tubular casing. (See cut.)

1,161,670. High-Tension Converter System. P. C. Hewitt, assignor to Cooper Hewitt Electric Co. Alternating source supplies direct-current work circuit through vapor rectifier with provision against short-circuits.

1,161,681. Car-Axle Lighting. R. C. Hull and J. L. Woodbridge, assignors to Electric Storage Battery Co., Philadelphia, Pa. Voltage regulated in three-pole, three brush generator.

1,161,683. Time-Controlled Shutter-Releasing Means. C. Hutter, assignor to General Electric Co. Time train controls magnet operating shutter detent.

1,161,708. Alarm Apparatus. W. McCleary, Hammond, Ind. Oil-sealed contact chamber.



No. 1,161,668.—Three-Volt Dry Battery.

1,161,716. Electric Switch. E. B. Merriam, assignor to General Electric Co. Venting arrangement for oil switch.

1,161,723. Protective Device for Cables. W. Pfannkuch, assignor to General Electric Co. Multiple conductors divided into insulated groups have low potential difference impressed; current flow indicates insulation breakdown.

1,161,734. Art of Electric Telescopy. B. Rosing, Petrograd, Russia. For transmitting luminous pictures.

1,161,746. Liquid Rheostat. G. Squire, assignor to General Electric Co. Circuit made through adjustable liquid stream.

1,161,748. Electric Heat-Storage System. W. Stanley, assignor to General Electric Co. Stove has highly heat-insulated storage mass for accumulating heat from electric energy supplied at low rate.

1,161,750. Apparatus for the Treatment of Fluids With Coagulants. A. P. Strohmenger, assignor to Ester & Co., Ltd., London, England. Fluid passed through cathode tube containing anode rod of aluminum.

1,161,752. Electric Switch. G. B. Thomas, assignor to Perkins Electric Switch Mfg. Co., Bridgeport, Conn. Rotary switch has auxiliary snap blade.

1,161,762. Holder for Telephones and Other Articles. C. H. Bartlett, Cambridge, Mass. Adjustable clamp adapted to grip telephone base.

1,161,783. Telephone Trunk - Release System. J. L. E. Meyer, assignor to Automatic Electric Co., Chicago, Ill. In automatic system, relative connections of release magnet for trunking system line switch, release relay and high-resistance supervisory relay.

1,161,793. Egg-Tester. F. W. Schroeder, Bemidji, Minn. Lamp lighted by placing of egg tray in position.

1,161,801. Vapor Electric Apparatus. E. E. Darmois and M. A. E. Leblanc, Paris, France. Light path in mercury-vapor lamp equally constricted near each electrode.

1,161,819. Magnetic Controlling Device. H. Grob, Zurich, Switzerland. Full movement of magnetically attracted member assured after initial movement.

1,161,820. High-Tension Converter System. P. C. Hewitt, assignor to Cooper Hewitt Electric Co. Has anode-protecting band about throat connecting anode and main chambers of mercury-vapor rectifier.

1,161,822. Terminal Connection for Electric Lamps. F. G. Keyes, assignor to Cooper Hewitt Electric Co. Terminal junctions for tungsten filament.

1,161,823. Terminal Connection for Lamp-Filaments. F. G. Keyes, assignor to Cooper Hewitt Electric Co. For connecting metal filament with lead.

Reissue 14,015. Condenser Arrangement. A. R. Pullock, assignor to H. C. Lee, Los Angeles, Cal. Original No. 1,048,034, dated Dec. 24, 1912. In apparatus for converting alternating to direct current.

Reissue 14,020. Electric Connector. J. C. Stearns, Worcester, Mass. Original No. 1,096,138, dated May 12, 1914. For coupling plug with lamp base.

Patents Expired.

The following United States electrical patents expired on November 29, 1915:

614,819. Process of and Apparatus for Covering Wire with Asbestos. E. Albasini, Turin, Italy.

614,839. Method of Forming Electrical Connections. W. B. Cleveland, Cleveland, O.

614,875. Trolley for Electric Cars. H. W. Libbey, Boston, Mass.

614,882. Junction Box. T. J. Murphy, New York, N. Y.

614,914. Mechanism for Controlling Electric Circuits. G. H. Whittingham, Baltimore, Md.

614,930. Process of and Apparatus for Separating Metals from Ores by Electricity. G. D. Burton, Boston, Mass.

614,946. Telephonic Microphone. W. D. Ghorkey, Philadelphia, Pa.

614,964. Dynamo-Electric Machinery. J. S. Lewis and F. J. Howitt, Manchester, England.

614,982. Automatic Time Electric-Circuit Switch. F. Richard, Boston, Mass.

614,995. Underground Conduit for Electrical Conductors. C. S. Sewall, Chicago, Ill.

615,057. Electromechanical Striking Mechanism. C. E. Beach and H. W. Doughty, Binghamton, N. Y.

615,136. Electric Metal-Heating Process. G. D. Burton, Boston, Mass.

615,172. Primary Battery. H. K. Hoss, Philadelphia, Pa.

615,186. Electric Safety Device. J. F. Kelly, Pittsfield, Mass.

615,209. Electrical Hinge Contact. C. Baxter, New York, N. Y.

Electric Vehicle Section

ELECTRIC VEHICLES IN MUNICIPAL SERVICE.

Data on Economy Effected in Numerous Installations.

Aside from the fact that there is a very extensive and profitable field for the sale of electric vehicles for municipal service, central-station companies and manufacturers could well devote greater attention to this class of prospects, if for no other reason than that the use of electrics by fire departments, police departments, street-cleaning departments, etc., would tend to place the electric before the public in a very favorable light. It is well recognized that every vehicle on the streets is an advertisement. This advertising value would be very materially enhanced were it shown that electric vehicles are used in services where absolute reliability is of the greatest importance, as, for instance, in fire-department or police work.

Some interesting data on this subject were presented in a paper recently by A. J. Slade and R. D. Dumont, it being shown that in practically all city work where haulage or transportation is required, electric vehicles can be used with attendant economy in operation and maintenance.

Fire-Department Service.

No municipal service presents such a complicated set of problems in mechanical haulage as does the fire department, and yet it is the department which has been motorized, not only in large cities but in small villages as well, for a longer time and to a far greater extent than any other. All conceivable types and combinations of types of motive power and application have been used, most of them with success, and one system can not broadly claim superior advantages over another in view of the widely divergent service requirements. One community has a fire district covering many square miles; another is limited to a small area. One has excessive grades; another is comparatively level. One has heavy winter snow falls; another has a semi-tropical climate. One has high-pressure pumping stations for its fire mains; another has not. One has many sky scrapers, districts where hazardous manufactures are carried on, densely populated tenement districts of non-fireproof character; another has entirely different types of business and residential sections.

These variations from any standard which one may choose to assume, as may be done in the case of commercial merchandise transportation problems, necessitate the wide variations in type of apparatus and motive power which we actually find in use.

To intelligently determine on a motor-propelled fire equipment, the existing local conditions must be investigated and analyzed, the existing horse-drawn equipment must be considered with reference to its utilization, and the organization of the department must be studied in its relation to the operation of the mechanical apparatus.

Among the varying conditions, instances are found where electric equipment has been installed and is giving satisfactory and economical service, notably in Philadelphia and Baltimore. Some recent figures furnished by the Philadelphia Fire Department on engine No. 20, both horse operated and electrically operated, are as follows:

HORSE-DRAWN APPARATUS.
Engine No. 20, Cost for 2 Years.

Two horses	$ 400.00
Forage	553.60
Shoeing	240.00
Depreciation	940.00
Repairs	600.00
Harness	96.00
Total	$2,829.60
Per year	1,414.80

MOTOR-DRIVEN APPARATUS.
Same Engine, Electrically Motor-Driven
Maintenance for 2 Years.

Current	$1,200.00
Repairs	480.00
Depreciation	922.40
Total	$2,602.40
Per year	1,301.20

The actual saving in cost of electric over horse operation appears to be only about 8 per cent, but its speed is nearly 300 per cent greater, a feature of vital importance in fire apparatus.

Street Cleaning and Refuse Collection.

The use of motor vehicles and especially electrics in street-cleaning operations has not yet become general, in fact may be considered to be in an experimental stage. The usual mechanical methods employed for cleaning streets are sweeping with rotary broom behind a water sprinkler to lay the dust; scrubbing with a rotary rubber squeegee in connection with a liberal water supply from a sprinkling tank which is a component part of the apparatus; flushing at 30 to 40 pounds water pressure from a tank supply, the nozzle pressure being obtained by a power-driven pump, though in some instances a tank pressure is obtained when filling from the hydrants if the pressure in the water mains is sufficient It is with this latter system that the limited number of electric street cleaners in North America have been equipped, and Canada probably has as many such vehicles as the United States. Few figures of operating cost are available, but it is obvious that as the duty of these electric vehicles is merely to transport gradually diminishing loads of water, the economy is as great as that of any merchandise carrying electric for similar mileages. The time of filling is practically the same as discharging, so that at 10 miles per hour during an 8-hour day, a battery capacity of 40 miles per charge is all that is required. The use of a power-driven pump would require a duplicate battery equipment, with means for quick interchange, as a discharge of 300 gallons per minute at 40 pounds would require about 10 horsepower, allowing 50 per cent combined efficiency of motor and pump, or 30 kilowatt-hours extra battery capacity. With adequate facilities for recharging, boosting and interchanging batteries of various capacities so that weather, grade and pavement conditions can be compensated for, it is not at all impossible that certain municipalities might find such a system very advantageous not only for flushing, but for sweeping and scrubbing, as well as for other operations.

Robert Mackay, superintendent of Electric Light, City of Calgary, Canada, supplies the following figures on trucks in municipal service in that city:

Capacity tons	1	1	3	3	5	5	5	1
Cost to date	1933.03	1955.85	2468.76	2417.52	2997.29	3033.54	2564.58	885.59
Average per month	214.78	217.32	274.31	268.61	233.03	337.06	284.95	177.12
Total miles	7,176	7,061	5,080	5,375	4,581	5,855	5,208	1,475
Nos. in service	9	9	9	9	9	9	9	9
Cost per mile	0.2692	0.2769	0.4860	0.4516	0.6542	0.5011	0.4924	0.6004

It will be observed that the mileage covered by these vehicles is very low, being from one-third to one-half of their mileage capacity, and in consequence the cost per mile is high. Garage expense, drivers' wages, estimated depreciation (figured at 20 per cent), and similar fixed charges and

distributed over too short a mileage to show marked economy. Nevertheless, Mr. Mackay states:

"Two 5-ton electrics in street-cleaning department effect a daily saving of $24 sprinkling and flushing during summer months. The sprinklers are operated in day and night shifts, of 9 hours sprinkling by day and 8 hours flushing by night at a saving of $24 per day of 17 hours over horse-drawn machinery. During winter months the tanks are removed and replaced by boxes which will hold six cubic yards of refuse.

"Calgary has 1,300,000 square yards of pavement, covering 54 miles of paved streets. The full equipment for keeping this clean consists of four horse flushers, four rotary brooms, two squeegees, five horse shrinkling carts and two 5-ton electric trucks. In a test the two trucks used by the street cleaning department averaged 38 miles each per day of 9 hours' sprinkling, and 17 miles each per night of 8 hours' flushing. The work cost $1.30 per truck for energy during the 17 hours."

Prominent phases of the problem to be investigated and analyzed include:

(1) Method of final disposal.

(2) Traffic conditions and the limitations on design effected thereby.

(3) Living conditions and effect of characteristics of inhabitants on motor vehicle design.

(4) Effect of variation in weather conditions.

(5) Seasonal variations in quantities of different classes of refuse.

(6) Type of street pavements and variations in grades.

(7) Functions required of the equipment.

(a) Refuse collection and transportation.

(b) Cleaning streets.

(c) Snow work (plowing, sweeping or carting).

An investigation along these lines in one of the districts in New York resulted in the design of a tractor trailer system, now being installed in service, by which house-to-house collection and transportation to point of disposal will be performed by day and various street cleaning operations at night. Thus the tractors will be operated on two shifts with different types of trailers and the saving over present methods will be substantial. While the conditions in the district in question and in other districts to which the system may later be extended led to the adoption of gas-electric tractors, it is highly probable that in many municipalities the storage-battery electric would prove to be the solution, especially with a battery interchange system.

As comparing the relative economy of electric and gasoline operation on transfer work, the following data have been obtained from the New York Street Cleaning Department on a 5-ton electric tractor and a 5-ton gasoline tractor, and estimates of operating costs of both machines have been made, based on this information:

Five-Ton Electric Tractor, and Five-Ton Gasoline Tractor, Department of Street Cleaning, City of New York.

The electric operates from stable at Flushing and Kent Avenues, Brooklyn, to Utica Avenue and Pacific Street, Brooklyn. Round trip, 7 miles; time, 1 hour, 10 minutes. Pulls trailer carrying from 14,400 pounds to 18,800 pounds. Repairs to electric tractor since beginning of operation, none. Renewals only on tires. Trailer has had several minor repairs. Makes five trips per day. Load equals six to eight carts. Gasoline tractor from same stable, makes trip with same load in 1 hour, 5 minutes. Breaks down frequently. Below is an estimated comparison of operating figure:

ELECTRIC.	
Depreciation at 10 per cent	$ 450.00
Interest at 6 per cent	270.00
Battery renewals and repairs	399.00
Mechanical parts upkeep	189.00
Tire renewals and repairs	336.00
Electricity at 0.05 perkilowatt-hour	543.00
Oil, water, etc	40.00
Total cost per year	$2,227.00
Total mileage annually	10,500.0
Cost per ton mile	$0.0565

GASOLINE.	
Depreciation at 20 per cent	$ 960.00
Interest at 6 per cent	288.00
Maintenance	120.00
Tires	656.25
Gasoline	471.00
Oil and grease	131.25
Total cost per year	$2,926.50
Total mileage annually	10,500.0
Cost per ton mile	$0.0743

A saving of approximately 40 per cent per ton mile.

Police Patrol.

The city of New York has in service one electric patrol wagon and a number of gasoline patrol wagons. The police department, through E. V. O'Daniel, fourth deputy commissioner, furnished the following figures and comments:

COST OF OPERATING ELECTRIC PATROL WAGON NO. 18.

Year	1913	1914	1915— 1st half	Totals
Batteries	$325.00	$128.10	$155.45	$608.55
Repairs	126.06	465.03	43.38	634.47
Oil and grease	4.00	0.20	4.60	8.80
Sundries	1.33	7.17	6.94	15.44
Tires	119.70	40.09	.....	159.79
Mileage	11,136	11,742	6,667	29,545

Cost of current, 6 cents per kilowatt-hour. Total, $36.42.

Distance covered in this period, 1,223 miles.

The average cost per mile is $0.0871. This is on the assumption that the electrical cost per mile was standard at $0.0298.

"In 1914 the car was completely overhauled. During the whole period, the repair items have been larger than would be the case with a car of more modern construction. This particular car has been in use about eight years.

"The batteries are charged at the Twenty-third Precinct, where our electric current rate is six cents per kilowatt-hour. Although saving could be effected by having the batteries charged at a station where the rate is lower, we cannot arrange to do this well on account of taking the car away from the district which it covers."

Amount of current used earns a 5-cent rate. The average cost per mile will therefore be $0.0822.

Cost of operation of gasoline motor patrol wagons, based upon cost figures for three cars, for 1 year, from June 30, 1914, to June 30, 1915:

3,049 Gallons gasoline	$ 367.84
154 Gallons oils	34.32
178 Pounds grease	18.49
18 Casings	527.40
11 Tubes, inner	68.81
Operation	$1,016.86
Sundries	57.89
Repairs	312.64
	$ 370.53
Mileage	14,984
Cost per mile	$0.0923

Age of cars, 2 years.
Comparison, gasoline car $0.0923 per mile
Comparison, electric car 0.0822
Saving of electric 0.01 per mile or 11 per cent.

On the gasoline machines, Commissioner O'Daniel furnishes the above figures, with the information that these figures represent an average, based upon the data for three cars of the same type. One of the cars had a general overhauling during the year, so that the repair item represents what the normal yearly cost of gasoline cars would be.

Electric Vehicles for Street Flushing.

The trend in municipal development towards greater efficiency and economy has spread to the transportation departments, and has resulted in numerous installations of motor-driven fire apparatus, police patrols and ambulances and other motor-driven vehicles for general haulage work. The motor-driven street flusher, which combines the functions of a sprinkler and sweeper, is a newer development, but because of its many advantages is rapidly gaining in favor.

The accompanying illustrations show two new types of electrically driven flushers manufactured by the General Motors Truck Company. As this company manufacturers both gasoline and electric machines and as the tanks and flushing equipment can be mounted on either chassis, the advantages which it claims for the electric are of particular significance.

An electric chassis is simpler in construction, simpler in operation, and simpler to maintain than a gasoline chassis.

Electric Truck "Prosperity"

The first practical gasoline automobile was built about 1886—the first real Electric truck 15 years later. Neither had much of a great demand success until 1909 or, say, 7 years ago. It takes time to introduce things so revolutionary.

The great bulk of the Electric trucks of the world have been built in the past *five* years. Each good Electric sold eventually sells two more, so production will increase rapidly once a certain distribution is reached.

Electric Truck "Prosperity" is here, already, for if you discount everything else, G. V. *reorders* alone would keep a big plant running. In addition there are thousands of business men who are being converted to the economic side of Electric trucking. Others are installing Electric trucks because this is in line with the entire electrification of their plant or store. Don't forget that the future of the Electric truck is limited only by the future of Electricity itself. The business man who claims that the Commercial Electric is "impractical", "no good", "needs a nurse" and so on, very frequently gets a short arm jolt when his competitor installs Electric Delivery.

G. V. Electrics have demonstrated over 10 years' life in hundreds of cases. They have covered as high as 21,000 miles each per year. They are efficient in hilly cities like Pittsburgh and Cincinnati. They are efficient in Winnipeg and Manila—two climatic extremes. Every so called weak point of the Electric has been given the lie in actual performance—*somewhere*.

Get the facts—you doubters—get the facts! *Specific adaptability* is all that is needed to place the Electric (the G. V. at least) absolutely at the head of efficient trucking. Let it be our pleasure to show you Why. Our new catalogue awaits your address.

General Vehicle Company, Inc.
Long Island City, N.Y.
New York, Chicago, Boston, Philadelphia

Copyright, 1915

2522

Electric Flusher Throwing Stream of Water.

It has no gasoline motor with its multiplicity of rotating and reciprocating parts and auxiliary appliances, no clutch, and no transmission—the three units which cause 90 per cent of all gasoline-car troubles.

Under ordinary conditions it can be operated for 75 to 80 per cent of the cost of operating a gasoline truck of the same size; and where conditions are exceptionally favorable, this percentage can be substantially reduced.

The average unskilled laborer can be taught to operate an electric flusher with one day's instruction. No high-priced, temperamental, skilled mechanic required.

Its simplicity of construction and operation make it more reliable and efficient in its work than a gasoline flusher.

The history of electrical development during the past twenty-five years shows a constant reduction in the cost of electrical current. Who can say what gasoline will cost two years, or six months hence, or guarantee that it will not advance instead of decline?

The conditions under which a street flusher works are ideal for highly efficient and economical electric truck operation. As a flusher, it always works on paved streets. As a sprinkler, it always works on dry streets.

Its total daily travel is usually well within the capacity of the modern storage battery. In emergencies, "boosting" charges at convenient intervals will greatly increase its mileage.

It can be backed around and otherwise quickly manipulated for flushing street intersections (which is very important) without a slow and noisy shifting of clutch and transmission gears.

With its five forward speeds it can be speeded up or slowed down to deliver the right volume and pressure of water for the removal of sticky or heavy objects without the shifting of clutch and transmission gears.

The most effective flushing can be done at a speed not exceeding six miles per hour. To operate a gasoline flusher at that speed requires constant low-gear work, which greatly increases gasoline and oil consumption and materially shortens the life of motor, clutch and transmission. On the contrary, the electric motor operates with a lower current consumption at slow speeds and equal efficiency at all speeds.

ELECTRICAL VEHICLES PROVE GOOD HILL CLIMBERS IN DEPARTMENT-STORE DELIVERY SERVICE.

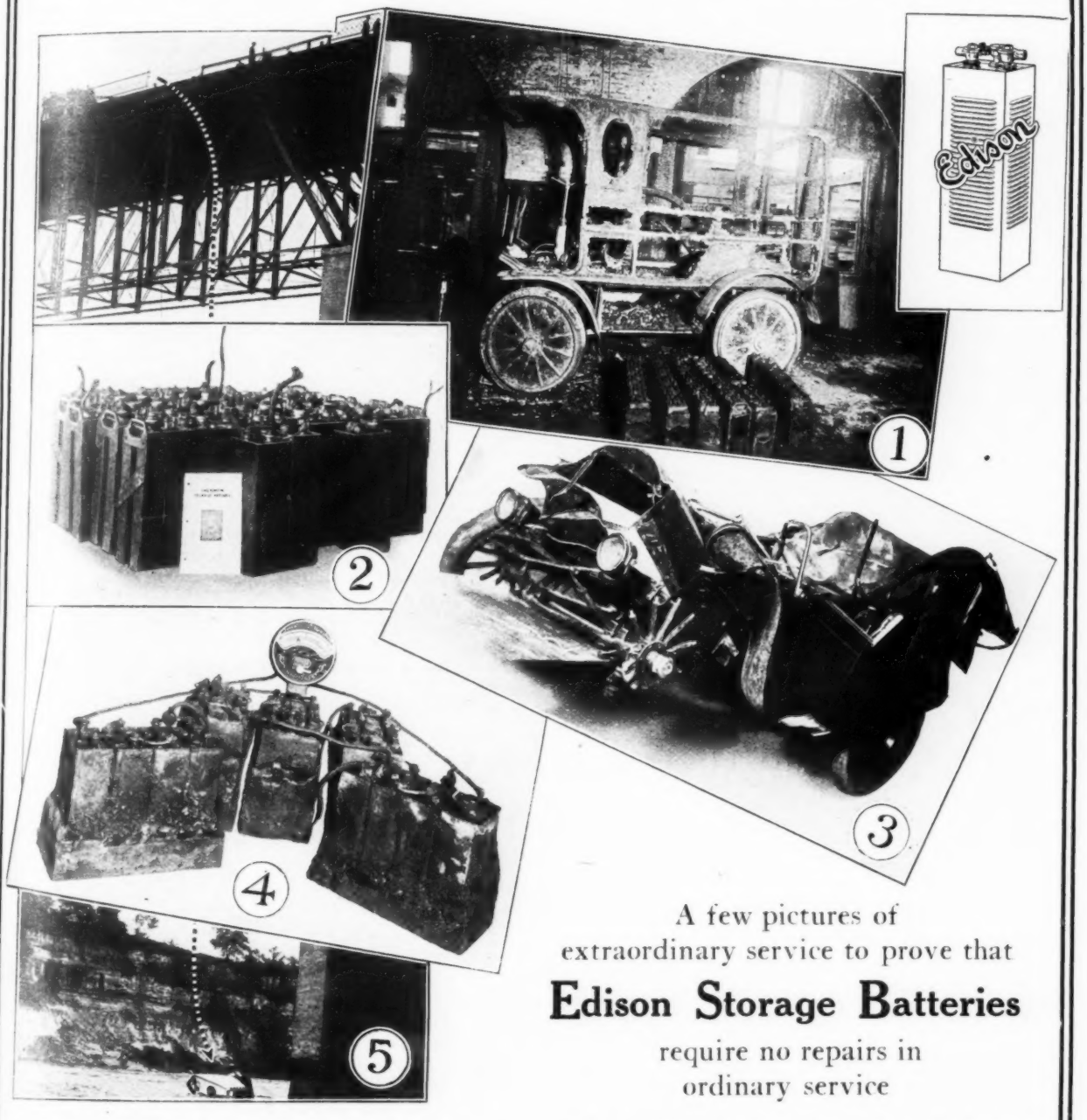
Low Cost Per Package Delivered.

By A. Jackson Marshall.

When a change is made in any delivery system from the horse-driven vehicle to the motorized vehicle, there is not only a revolution in the actual work of delivery, but entirely new standard and general methods of handling and transporting goods are established. To successfully operate a motorized fleet of delivery wagons the entire situation and its relations to all other parts of the business must be thoroughly studied and established on an engineering basis. The Electric Vehicle Association of America, which has been making a special study of delivery problems for some time past, has been fortunate in securing the testimony of a man who has been unusually successful in operating a fleet of electric delivery wagons. This very resourceful operator is A. N. Stanton, superintendent of the delivery department of Meier & Frank Company, a large department store in Portland, Ore. His intelligent handling of the delivery problem and suceessful operation of electrical equipment in a city noted for its steep hills, goes far to prove the feasibility of the electric truck for delivery service under conditions usually thought by the uninitiated to be prohibitive for the electric. Mr. Stanton's success has been due to his persistent and careful study of the direct bearing which electric delivery service has upon every phase of the business—new

Electric Street Flusher in Action.

Remarkable Ruggedness of the Edison Battery



A few pictures of extraordinary service to prove that

Edison Storage Batteries

require no repairs in ordinary service

1. **FIRE BURNED** the trays but only two cells were beyond repair after a fire of the Cambridge Electric Light Co. Rubber parts replaced in recanning made the Edison Battery as good as new.

2. **CYCLONE WRECKED** the Omaha garage containing the Detroit roadster (3) carrying this Edison Battery. Buried under tons of brick, jumpers twisted, short-circuited and burned off but every cell above rated capacity after being dug out.

4. **THE SURVIVOR** of a fire in the New York Yacht & Engine Co.'s shipyard. The boat was totally destroyed, leaving these Edison cells on the wreckage. The charred insulation permitted a test: Voltage O.K. and a No. 14 wire made red hot.

5. **ONE HUNDRED FOOT DROP** of a Purity Baking Co.'s electric delivery wagon in St. Paul. Before any repairs were made on the Edison Battery every cell was found to be well above rated capacity.

Write for Bulletin 500 on Commercial Vehicle Batteries

Edison Storage Battery Company, Main Office and Factory **Orange, N. J.**

Distributors in New York Boston Chicago Detroit Washington San Francisco
Los Angeles Portland, Ore. Seattle

methods of packing, receiving, storing, handling, shipping and discharging merchandise.

That electric vehicles have been chosen as the most efficient method of delivery by such an important company as Meier & Frank, and are giving perfect service in what is probably one of the hilliest cities in the world is a high tribute to the ability of the electric which is not always given due credit for its remarkably good hill-climbing qualities.

Particular attention is directed to Mr. Stanton's illuminating remarks relative to the multiplicity of motions required in the operation of the complicated gasoline machine. It is extremely doubtful if the lay mind can conceive of the great and continuous strain imposed on a gasoline truck operator in frequent-stop service or when operating in city traffic. Even an approximation of this drain on human energy is sufficent to realize the grave danger to which life and property are subjected in the operation of thousands of gasoline vehicles whose operators have well nigh reached the exhaustion point near the end of a day's arduous duties. The physical and mental strain on gasoline truck operators dims the mind's alertness and destroys the agility necessary for instant decision and action in congested city traffic, and it is likely that we may not expect any very great improvement in existing traffic conditions until the more general introduction of the simple, safe and sane electric vehicle takes place.

Just one more thought before we proceed with Mr. Stanton's admirable article, and that is the highly successful operation of electric vehicles in hilly cities. There is no question but that in certain quarters the impression has prevailed that the electric would not negotiate hills. Nothing could be further removed from fact. Not only will electric vehicles operate in a thoroughly satisfactory manner in hilly districts, but they will probably travel up grades which the average gasoline car would not attempt.

Possibly the fact that the average gasoline car in order to get up a hill must race its motor and attack the grade with a flying start maintaining an excessive speed, in order to reach the top, gives some the impression that the gasoline car is better than electric. However, it must be realized that the electric, if it were required, could take hills as relatively fast as does the gasoline car with its strain on the mechanism and woeful waste of energy. But the electric vehicle's action on a hill follows the practice of all natural locomotions. When arriving on a grade either a greater amount of energy has to be expended to maintain the pace pursued on the level or the speed must be reduced in proportion to the grade without using a disproportionate amount of energy. There are grades which many gasoline cars could not negotiate without a so-called flying start, although on these hills the average electric will start from a stationary position and will furthermore stop and even back and then continue up the hill at the will of the operator. Merchants, and especially those who drive pleasure cars—should get this fact firmly fixed in their mind that the driving of a pleasure car, even at a very high cost per mile is chargeable to pleasure and therefore not subject to the scrutiny directed toward commercial transportation. Furthermore, it should be understood that a pleasure car is not a truck and the same fundamental principles will not apply.

The following interesting facts are quoted from an interview with Mr. Stanton and should prove very valuable to those interested in house-to-house delivery:

"Our interest in the matter of electric cars dates back to December, 1909, at which time we made a comparative test between a gas and an electric car in the delivery service, the entire motive power of our delivery at that time being horses.

"During this month of December we ran both the gas and electric cars as hard as possible, the cars being driven to their limit, with the idea of ascertaining which would be better for our purpose in the delivery service. After a test covering three weeks, we found upon figuring over the cost of operation of both cars that the electric was 0.7 of a cent per package cheaper to operate than the gas car and that the electric had delivered practically as many packages as the gas car.

"This matter was then laid before Sigmund Frank, who became much interested and who was the deciding factor in the selection and purchase of an electric car at that time. I can recall his assertion that there was more than one reason for his adoption of the electric car and that was the fact that there would be very little inducement for the driver to joy ride, whereas in his opinion, there would be considerable temptation of this kind with the gas car.

"On March 23, 1910, following the test mentioned, we purchased our first electric car, which was a single motor vehicle and which has given very satisfactory service. Shortly after the purchase of this car, which was of 800-pounds capacity, we purchased three more of 1,500-pounds capacity, these being equipped with double motors. Following these three 1,500-pound cars we purchased a one and two-ton truck of the same make, the latter being for the furniture delivery. From the operation of these six cars we concluded that the single-motor car suited our needs better than the double-motor car for many reasons.

"We then decided to build some cars in Portland, after our own ideas, with the result that a certain company built for us four one-ton delivery cars and one two-ton furniture car. The first of these cars was delivered to us in September, 1911, and is yet in perfect running order and has given the utmost satisfaction in service, being very economical to operate and very low in upkeep cost.

"One of the earliest records made by this car was on September 30, 1911, at which time the car made 157 stops in 195 minutes and ran 14.5 miles from the time it left the garage until its return. Later in November of the same year we took out this car with 340 stops, covering a distance of 37.5 miles in one day. This was the star performance for an electric car in our service up to that time, but a later record eclipsed this, being 740 stops, covering 55 miles, which record we offer as a challenge to any department store in the United States.

"We had then in our service up to the beginning of 1912, 11 electric cars, which was our entire equipment of motor vehicles. In June, 1912, we purchased four gas trucks, being the first gas cars operated in our delivery service, and after operating these cars for some months we again turned to the electric, ordering four 3,000-pound cars, all of which we put in service the early part of 1913. All of the later electric cars were equipped with nickel-iron batteries as against lead batteries in the first cars and although there has been a great deal of argument, pro and con, regarding the cost of operating the lead as against the nickel-iron, we find that there is, so far as the charging cost is concerned, practically no difference between them, but when steadiness of service is taken into consideration, the nickel-iron is more reliable. I will explain this by saying that the original radius of mileage given out by the nickel-iron is maintained much more uniformly than is the original radius of mileage obtained from the lead.

"It may seem a very small thing to consider the number of motions made by a driver in operating his car during the day's work, but when you stop to consider that the starting and stopping of a gas car requires 12 motions by the driver and the starting and stopping of an electric car but five motions, a difference of seven motions, and that during the busy day when 300 stops are made, that it requires 2,100 more motions on the part of the driver of a gasoline car than of an electric, you

Here Are The ELECTRIC VEHICLE MAKERS Who Use The "Exide" Batteries

"Exide" "Hycap-Exide" "Thin-Exide" "Ironclad-Exide"

AMERICAN ELECTRIC CAR CO., Saginaw, Mich.
(Includes Argo, Broc and Borland "Electrics")

ANDOVER MOTOR VEHICLE CO., Andover, Mass.

ATLANTIC ELECTRIC VEHICLE CO., New York, N. Y.

THE BAKER R & L CO., Cleveland, Ohio.

COMMERCIAL TRUCK CO., Philadelphia, Pa.

EMPIRE ELECTRIC VEHICLE CO., Owego, N. Y.

GENERAL MOTORS TRUCK CO., Pontiac, Mich.

GENERAL VEHICLE CO., Long Island City, N. Y.

KENTUCKY WAGON MANUFACTURING CO., Louisville, Ky.

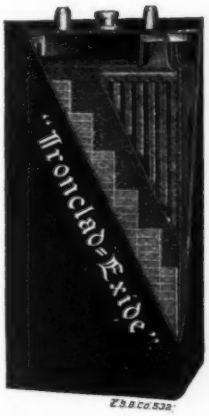
OHIO ELECTRIC CAR CO., Toledo, Ohio.

WALKER VEHICLE CO., Chicago, Ill.
(Includes Chicago Electric Pleasure Cars and Walker Electric Trucks)

THE WAVERLEY CO., Indianapolis, Ind.

WOODS MOTOR VEHICLE CO., Chicago, Ill.

"Exide" Cell cut away to show construction



"Ironclad-Exide" Cell cut away to show construction

THE ELECTRIC STORAGE BATTERY CO.

Manufacturer of

The "Chloride Accumulator", The "Tudor Accumulator"

The "Exide", "Hycap-Exide", "Thin-Exide" and "Ironclad-Exide" Batteries

New York Boston Chicago Washington **PHILADELPHIA, PA.** Denver San Francisco Seattle St. Louis
Cleveland Atlanta Pittsburgh Detroit **1888 1915** Rochester Los Angeles Toronto

will see that this is no small consideration. With even a slight motion of the body multiplied so many times, and added to the driver's other responsibilities, it is certainly a matter to be reckoned with and any of the drivers will confirm this.

"We met with considerable opposition among the drivers in our early purchase of electric cars, as it seemed to them that an electric car must necessarily be a cumbersome thing as well as tiresome to operate, but after operating both the gas and electric cars for a considerable time, the drivers will tell you the electric car is easier to drive, both from a physical as well as a nervous standpoint.

"The consideration of upkeep is a very interesting item. For the year 1914 we find that the upkeep cost per mile for gas cars was 3.62 cents; for the electric cars, 2.57 cents, a difference of 1.05 cents in favor of electric cars. Considering this matter per mile does not show in the aggregate, very favorably for the electric car as our gas cars traveled 134,614 miles as against the electric cars 90,180 miles, a difference in favor of the gas cars of 44,334 miles, but when money expended is considered, we find that $2,551.09 more was expended on a like number of gas cars than was expended on the electric cars. This is equivalent to more than 100 per cent in favor of electric cars in upkeep cost.

"In the matter of speed, all I need say in this regard is that the electric car holds the record for the greatest work ever done in one day in our delivery—namely 740 packages covering a distance of 55 miles, all this without an error. Nor would it have made any difference in this day's work had the car been capable of making 30 miles an hour for there was no opportunity to use such speed, the ability of the car to make a quick stop and start being the prime consideration and in this the electric car excels. In analyzing the routes I have not been able to list the stops by entering on the analysis sheets the number of the stops, number of packages delivered at the stop, the street address and mileage as quickly as the deliveries were made for they were frequently made in 30 seconds or less, and although everything was ruled and in readiness for the work, I was very frequently holding the driver back.

"We often hear the remark 'surely you must yield the palm to the gas car in hill climbing,' but we refer to our records for reply and at least take the edge off the gas car enthusiast by showing that every day and often three times a day we climb the following gradients (quoting from our records in percentages) 5, 9, 11, 15, 17 and 20. And, to quote again from our records:

"On 5 per cent grades our meters showed we were using 65 volts and a 75-ampere draw.

On 9 per cent grades 62 volts and 80 amperes.
On 11 per cent grades 55 volts and 125 amperes.
On 15 per cent grades 43 volts and 132 amperes.
On 16 per cent grades 43 volts and 140 amperes.
On 17 per cent grades 42 volts and 145 amperes.
On 20 per cent grades 42 volts and 170 amperes.

"The normal voltage of this motor is 60 and amperage 40 at 1,200 revolutions per minute and you can see what this outfit is doing year after year without complaint and partially without expense to its owners."

Plans for Boston Motor Show.

The Boston Auto Show, at which many electric vehicles are shown annually, will be held March 4 to 11 at Mechanics Building, Huntington Avenue. The exhibition of pleasure cars and trucks will be combined, as was the case at the last show. Boston's exhibition has the reputation of being the best "selling" show in the country, and the number of electrics contracted for in former years has been large.

The automobile industry in New England is enjoying increasing prosperity, especially in the motor truck branch. The coming exhibition in Boston will mark the greatest forward stride that the manufacture of commercial motor vehicles has taken since this type of transportation was developed. It is expected that a number of new makes will be shown for the first time.

The Ward Electric Cross-Country Trip.

The two accompanying illustrations show typical road conditions which had to be overcome by the Ward electric delivery wagon in its notable run from New York City to Cleveland, O., last October. Starting from New York on October 6, good roads were traversed until Utica, N. Y., was reached. From this point west, almost to Cleveland, much road-construction work was underway, and as it rained almost continuously during the run the roads were all but impassable. The fact that the Ward covered the distance of 733.7 miles at an average speed of eight miles per hour, in spite of poor road conditions, speaks well for the machine.

Two Views of Ward Electric Enroute from New York to Cleveland.

On the entire trip only 23 charges of battery were necessary, the total current consumption being 1,564 ampere-hours.

The value of the mineral production of the United States in 1914, according to the United States Geological Survey, was $2,114,946,024, being exceeded only by that of 1913 and 1912.

The metallic products in 1914 were valued at $691,000,343 and the nonmetallic products at $1,423,395,681.